

Notes on the *Helophorus*
(Coleoptera, Hydrophilidae)
occurring in Turkey, Iran
and neighbouring territories

by

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With 68 figures

ABSTRACT

Following study of material brought back by expeditions from the Natural History Museum, Geneva, the National Museum of Natural History, Prague, the Natural History Museum, Vienna, and other material, an account is given of the *Helophorus* known to occur in Turkey and Iran. Thirty six species are known from these countries, and *H. (Trichelophorus) oscillator* Sharp, from northern Israel is also discussed as the Geneva material is by far the most extensive known for this species.

Five new species, all in subgenus *Atracthelophorus* Kuwert, are described: *H. difficilis*, from Turkey, Lebanon and Israel; *H. yammounensis*, from Lebanon and Israel; *H. ponticus*, from Turkey; *H. zagrosicus*, from Turkey and Iran; and *H. wrootae*, from Corfu (Greece). In addition, a new subspecies, *levantinus*, from Turkey, Lebanon, Syria, Iraq and Iran, is described for *H. brevipalpis* Bed.

Specimens of *H. aquaticus* (L.) from near the Bosphorus are shown to have unusually large aedeagophores, and variation, especially of the aedeagophore, is discussed for *H. brevipalpis* Bed. and *H. pallidipennis* Muls. & Wach.

References to taxonomic treatments of all the species mentioned are given, as well as details of their distribution.

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INTRODUCTION

Study of the extensive collection of *Helophorus* brought back from Turkey and Iran by a series of expeditions from the Muséum d'Histoire naturelle, Geneva, as well as material brought back by expeditions from the National Museum, Prague (detailed by HOBELANDT 1974, 1981, 1983), and the Natural History Museum, Vienna, and a collection of Iranian *Helophorus* made by Mr. R. McCullers, gives a fair indication of the fauna of the area.

The Geneva material includes representatives of three new species, and also permits analysis of variation in *H. aquaticus* (L.) and *H. brevipalpis* Bed., of which a new subspecies, *levantinus*, is described. In addition, two further new species are described, one from Corfu (Greece) and one from Lebanon.

I have not attempted to list all records from all sources for Turkish and Iranian *Helophorus*, but have included such records where they provide important additional information. Prominent in this category is *H. pallidipennis* Muls. & Wach., whose identity and variation are discussed.

Details of the number and sex of the specimens are given only where they appear to be of particular interest — for analysis of variation, or where accurate identification requires study of the male genitalia.

The faunas of Turkey and Iran are to some extent linked geographically by that of the Russian Transcaucasus, and information on the fauna of this region is drawn from study of the collections in the Zoological Institute, Leningrad. There are four *Atracthelophorus* species, *H. armeniacus* Ganglbauer, *H. costulatus* Kuwert, *H. guttulus* Motsch. and *H. richterae* Angus, known from Transcaucasia but not Turkey or Iran. They are not included here but are discussed by ANGUS (1985a). All other known Caucasian species are included.

The three museums listed above are indicated by the letters G (Geneva), P (Prague) and V (Vienna) in the species list. McCullers's material is at present in my collection.

The arrangement of subgenera is that given by Angus (1984), where a key is given. Where possible, references to papers giving taxonomic treatment of the species are given for each subgenus.

Subgenus *Transithelophorus* Angus, 1970

Key to species: ANGUS 1984.

H. terminassianae Angus

TURKEY. Konya: Bakaran, 50 km south of Beyşehir. Under stones at an altitude of 1400 m, 7.V.1978. Besuchet-Löbl (G.); Izmir. "Sewdiköi bei Smyrna, 21-29.IV.1917. S. G. LaBaume". In the Humboldt Museum, Berlin.

These are the only known specimens, apart from the holotype and paratype from Soviet Armenia. This species is apparently rather closely related to *H. micans*, and the aedeagophores of the two species are not distinguishable. *H. terminassianae* may be distinguished from *H. micans* by its flatter pronotum which has the sides scarcely excised before the hind angles and has the grooves less shining and with the small non-setigerous granules more developed than in any *micans* I have seen. The elytra have the outermost

interstice very strongly keeled, and when viewed from above the inner part of this interstice forms a broad ledge running along the side of the elytron, far broader and more prominent than in *H. micans*. This gives *H. terminassianae* noticeably broad elytra, compared with the pronotum. (See ANGUS 1984, Figs 7, 13 and 14).

Subgenus *Empleurus* Hope, 1838

Key to species: ANGUS 1984.

H. nubilus F.

TURKEY. Kırklareli, 11 km SE of Demirköy, 31.VII.1969, Besuchet (G.). Istanbul, Yalova Orhangazi, 11.V.1976, Besuchet (G.). Muğla, between Çetibeli and Marmaris, 1.V.1975, Besuchet-Löbl (G.). Muğla, Bayir, 25 km NE of Kemar, 950 m altitude, 3.V.1975, Besuchet-Löbl (G.). Sakarya, between Sakarya and Geyve, 27.V.1967, Besuchet (G.). Isparta, between Egridir and Candir, 950 m altitude, 6.V.1975, Besuchet-Löbl (G.). Çamildere, Anatolia, 23.VI.1947 (P.). Zonguldak, Alaplı, 15.V.1976, Besuchet-Löbl (G.). Zonguldak, between Eregli and Balıköy, 15.V.1976, Besuchet-Löbl (G.). Ankara, Soguksu National Park, 1000 m altitude, 20.V.1967, Besuchet (G.). Ankara, Çankaya, Anatolia, 2.VII.1947 (P.). Mersin, between Mersin and Yeniköy, 650 m altitude, 29.IV.1976, Besuchet-Löbl (G.). Konya, 18 km SW of Beyşehir, 1200 m altitude, 7.X.1978, Besuchet-Löbl (G.). Sluhan, Toros, Anat., 2.VIII.1947 (P.). Namrun, NE of Tarsus, 1170 m altitude, 11.IV.1966 (V.). Small stream 25 km W of Şemdinli, 3.VI.1987, Jäch (V.). 60 km SE of Tatvan, 8.VI.1987, Jäch (V.), Mutki, W of Tatvan, 11.VI.1987, Jäch (V.). S.E. Turkey, Beytüşebap, 31.VI.1987, Jäch (V.). Between Muş and Bingöl, 11.VI.1987, Jäch (V.). Amanos Mts (= Gavur Dağları), 24.V.1987, Jäch (V.). Hizan, S. of Lake Van, 8.VI.1987, Jäch (V.).

IRAN. E. Azerbaijan: ESE of Hero-Abad, 37°35'N, 48°39'E, 12.VII.1974, Senglet, 1 specimen (G.). Mazanderan: Ivel, 1500 m altitude, 36°14'N, 53°27'E, 11.VII.1975, Senglet, 1 specimen (G.). Baladeh, 2200 m altitude, 36°13'N, 51°49'E, 12.VII.1974, Senglet, 1 specimen (G.). Tehran: Loc. No. 82, Gardenehe Gaduk pass, 35°55'N, 52°55'E, 2200 m altitude, 2.VIII.1970 (P.). Guilan: Nav's valley, 1800 m altitude, 3.VIII.1973, S. Vit. 1♂ (G.). Kermanshah: Kenesht/Kermanshah, 34°29'N, 47°09'E, 3.VIII.1973, Senglet, 1♂ and 1 unsexed (G.). Mahi Dasht, 34°14'N, 46°42'E, 4.VIII.1973, Senglet, 1 specimen (G.). Sahneh, 34°28'N, 47°36'E, 2.VIII.1974, Senglet, 1 specimen (G.).

These Iranian records represent the most southeastern limits of the known distribution of *H. nubilus*.

H. hirsutiventris Angus

TURKEY. Istanbul, between Yalova and Orhangazi. Among dead leaves and old stumps in an oak wood, 11.V.1976, Besuchet-Löbl, 1♂ (G.). Sakarya, between Sakarya (= Adapazari) and Geyve, 22 km from Sakarya. 27.V.1967, Besuchet, 1♂ (G.).

GREECE. Epire, Mt-Mitsikelo, Ampelos, Megalo Peristari, Konitsa, 11 specimens (G.). Arkadia, Manalon Mts 1♂, coll. Weirather (G.).

This species was described from Albania, Yugoslavia and Mt-Parnassus in Greece.

Subgenus *Eutrichelophorus* Sharp, 1915

Key to species: ANGUS 1984.

H. micans Fald.

- TURKEY. Izmir, Efes, 8.V.1975, Besuchet-Löbl (G.). Balikesir, Ayvalik, 15.VII.1969, Besuchet (G.). Burdur, Çerçin, L. Burdur, 870 m altitude, 6.V.1975, Besuchet-Löbl (G.). S of Islahiye, 100 km N of Antakya, 26.VI.1987, Jäch (V.). Tuz Gölü, 21.V.1987, Jäch (V.). Karacadag near Diyarbakir, 28.V.1987, Jäch (V.). Hizan, S of Lake Van, 8.VI.1987, Jäch (V.). Lake Van, east bank, 7.VI.1987, Jäch (V.).
- IRAN. E. Azerbaijan: Near Mahabad, 36°50'N, 45°47'E, 3.VI.1975, Senglet (G.). N. of Khoy, 38°38'N, 45°02'E, 1.VI.1975, Senglet (G.). W. Azerbaijan: Qarazia-ed-Din, 38°56'N, 45°03'E, 21.IX.1975, Senglet (G.). E. of Miyaneh, 37°28'N, 47°52'E, 8.VI.1975, Senglet (G.). Bostanabad, 37°48'N, 46°51'E, 25.VI.1973, Senglet (G.). Guilan: Zenjan, 36°43'N, 48°21'E, 15.IX.1973, Senglet (G.). Djavaherdeh road, 1200 m altitude, 36°55'N, 50°33'E, 7.VIII.1974, Senglet (G.). Kordestan: Santeh, 36°11'N, 46°32'E, 23.VI.1975, Senglet (G.). Mazanderan: Naharkoran/Gorgan, 36°44'N, 54°29'E, 20.VII.1973, Senglet (G.). E. of Baladeh, 2000 m altitude, 36°12'N, 51°57'E, 8.VII.1975, Senglet (G.). Aliabad, 36°53'N, 54°57'E, 30.VII.1974, Senglet (G.). Gol-e-Loveh, 700 m altitude, 37°20'N, 54°44'E, 21.VIII.1975, Senglet (G.). Feyzabad, 25 km E. of Gorgan, 36°52'N, 54°33'E, 27.VII.1970 (P.). Robate-Ghozlog, 10 km S of Gorgan, 500 m altitude, 36°50'N, 54°29'E, 26.VII.1970 (P.). Behshahr, 36°43'N, 53°34'E, 25.VII.1970 (P.). Tehran: N of Avadj, 35°36'N, 49°13'E, 14.VI.1976, Senglet (G.). Agha Baba, 36°19'N, 49°49'E, 6.VII.1974, Senglet (G.). Kermanshah: Sahneh, 34°28'N, 47°36'E, 2.VIII.1973, Senglet (G.). Garavand/Shahabad, 35°55'N, 46°47'E, 5.VIII.1973, Senglet (G.). Kenesht/Kermanshah, 34°29'N, 47°09'E, 3.VIII.1973, Senglet (G.). Kangavar, 34°29'N, 47°55'E, 1.VII.1974, Senglet (G.). Bakhtiyari: Kuhrang, 32°28'N, 50°80'E, 19.VI.1974, Senglet (G.). Organ, 32°35'N, 53°19'E, 8.VIII.1973, Senglet (G.). Dimeh, 32°29'N, 50°16'E, 21.VI.1974, Senglet (G.). Esfahan: Eshafan, 32°34'N, 51°31'E, 23.VIII.1973, Senglet (G.). Falavarian, 32°34'N, 57°26'E, 14.VI.1974, Senglet (G.). Pol-e-Kaleh, 32°34'N, 51°14'E, 15.VI.1974, Senglet (G.). Fars: Persepolis, 29°59'N, 52°54'E, 18.VIII.1973, Senglet (G.). Ghader-Abad, 32°21'N, 53°19'E, 17.VIII.1973, Senglet (G.). Izad Khast, 31°31'N, 52°09'E, 16.VIII.1973, Senglet (G.). Near Ghader-Abad, 30°22'N, 53°18'E, 11.VI.1974, Senglet (G.). Khorasan: Emamgholi, 37°26'N, 58°30'E, 15.VII.1974, Senglet (G.). Bodjnour, 37°29'N, 57°26'E, 26.VII.1974, Senglet (G.). 36 km S of Bidokht on the Birjand road, 34°00'N, 58°45'E, 8.VI.1975, R. McCullers.
- AFGHANISTAN. Wardak, NNE of Ghazni, 33°45'N, 68°34'E, 12.VIII.1975, Senglet (G.).
- PAKISTAN. Chitral, Kalas, 1900 m altitude, 28.V.1983, Besuchet-Löbl, 1♂, 1♀ (G.).
- The distribution of this species extends from eastern Austria and Israel (coll. M. Jäch) to Afghanistan. The Pakistan record is thus an extension to its known range.

Subgenus **Trichelophorus** Kuwert, 1890

Key to species: ANGUS 1984.

H. oscillator Sharp

ISRAEL. Golan, Mt-Hermon, 1600 m and 2000 m altitude, 23.IV.1982, Besuchet-Löbl, 4♂♂, 8♀♀ (G.).

As explained by ANGUS (1984), this is a little known species, and only now are there modern and accurate records of its occurrence. Dr. M. Jäch (Vienna) has also taken it on Mt-Hermon, and there is an old specimen from the same locality in the Plant Protection Institute in Eberswalde, E. Germany.

H. oscillator is identified as a *Trichelophorus* by the symmetrical apical segment of the maxillary palpi, the presence of intercalary striae on the elytra, and the tarsi which have fine swimming-hairs, not stiff setae, on their dorsal surfaces. It differs from *H. alternans* Gené in the much narrower elytral pseudopleura, only about half as wide as the true epipleura opposite the metasternum. This condition is matched by some species of subgenus *Meghelophorus*, and, should there be any doubt about the maxillary palpi, *H. oscillator* may be recognised by the fact that the pronotal grooves are all about as wide as the middle and external intervals, and the last fixed abdominal sternite lacks apical teeth. The only *Meghelophorus* species with wide pronotal grooves are *H. syriacus* Kuw. and the *H. maritimus* complex — all species with large bold teeth on the last fixed abdominal sternite. The aedeagophore of *H. oscillator* is similar to that of *H. aquaticus* (L.), when the outer margin of the parameres is only weakly curved, though the basal piece is rather shorter.

Subgenus *Meghelophorus* Kuwert, 1886

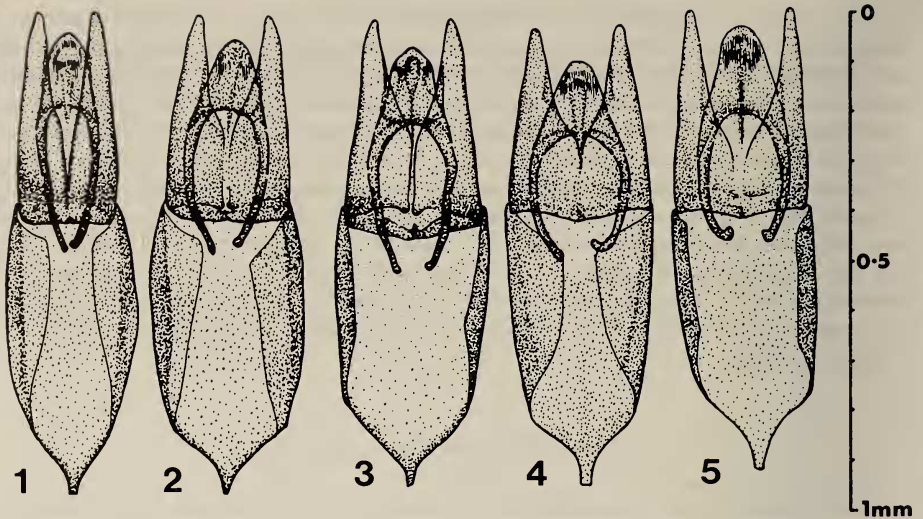
Key to species: ANGUS 1970a. Separation of *H. aquaticus* (L.) and *H. aequalis* Thoms.: ANGUS 1982. Separation of *H. grandis* Ill., *H. syriacus* Kuw. and the *H. maritimus* complex: ANGUS 1983.

H. aquaticus (L.)

TURKEY. Kirklareli, Demirköy, 71 km SE of Kirklareli, 12.VII.1969, Besuchet, 2♂♂, 1♀ (G.). Istanbul, Forest of Belgrade, 10.VII.1969 and 4.VI.1967, Besuchet, 3♂♂ (G.). Istanbul, Kilyos, 8.VII.1969, Besuchet, 1♂ (G.). 80 km W of Istanbul, 15.VI.1987, Jäch (V.). Bursa, South of Bursa, 23.VII.1969, Besuchet, 1♂ (G.). Sinop, Lala near Sinop, 20.V.1976, Besuchet-Löbl, 1♂ (G.). Isparta, between Egridir and Gandir, 950 m altitude, 6.V.1975, Besuchet-Löbl, 1♂ (G.). Bolu, between Bolu and Yeniçaga, 1000 m altitude, 24.V.1967, Besuchet, 1♂ (G.). Kastamonu, 13 km E of Agli, 1200 m altitude, 10.V.1976, Besuchet-Löbl, 1♀ (G.). Ankara, Soguku National Park, 1000 m altitude, 24.V.1967, Besuchet, 1♂ (G.). Kybelon Mts., Isaurian Taurus, Weirather, Innsbruck, 1♂, 2 unsexed (G.). Derik, W of Mardin, 950 m altitude, 8.V.1966, 2♂♂, 4♀♀ (V.). Mardin Mts. 30.V.1987, Jäch (V.). S.E. Turkey, 5 km W of Şirnak, 31.V.1987, Jäch (V.). Karaçadag near Diyarbakir, 28.V.1987, Jäch (V.). Diyarbakir, Karacadag, 1850 m altitude, 1983-1985, ♂♂, ♀♀. N. Lodos (Izmir). Between Muş and Bingöl, 11.VI.1987, Jäch (V.). Small stream 25 km W of Şemdinli, 3.VI.1987, Jäch (V.). Between Van and Baskale, 2600 m, Güzeldere P. 5.VI.1987, Jäch (V.). 60 km SE of Tatvan, 8.VI.1987, Jäch (V.). Kars, S of Karakurt, 1900 m altitude, 17.VI.1986, Besuchet-Löbl, Burckhardt, 1♂ (G.). Kars, Digor, 1650 m altitude, 15.VI.1986, Besuchet-Löbl-Burckhardt, 1♂ (G.). Erzerum, pass between Tortum and Narman, 2400 m altitude, 7.VI.1986, Besuchet-Löbl-Burckhardt, 1♂, 10 unsexed (G.).

IRAN. Hamedan: Asadabad, 34°51'N, 48°12'E, 2.VII.1974, Senglet, 2♂♂ (G.). Kermanshah: N of Kamyaran, 34°48'N, 46°57'E, 14.IX.1975, Senglet, 1♂ (G.). Bakhtiyari: Kuhrang, 32°28'N, 50°08'E, 19.VI.1974, Senglet, 1♀ (G.). Esfahan: Nowghan, 33°14'N, 49°59'E, 7.VIII.1973, Senglet, 1♀ (G.). E. Azerbaijan: N of Sofian, 38°21'N, 45°50'E, 5.VI.1975, Senglet, 1♀ (G.).

The specimens from Istanbul: Forest of Belgrade and Kilyos, Bursa and Sinop appear sharply distinct from the other males listed in that their aedeagophores are 0.94-0.97 mm long, as against about 0.82 mm in the others. These aedeagophores appeared conspicuously narrow (Fig. 1) when first dissected, but this appears to be an artifact of preser-



FIGS 1-5.

H. aquaticus (L.), aedeagophores, traced from photographs.

Localities as follows: 1, Istanbul, Forest of Belgrade; 2, Bursa; 3, Istanbul, Kilyos; 4, Spain, Provincia de Madrid, Peña Lara; 5, Spain, Provincia de Segovia, La Granja.

vation and drying. Soaking in 5% Potassium Hydroxide gave a more normal appearance (Fig. 2), while inadvertant slight pressure from a coverslip gave the appearance shown in Fig. 3 — a further artifact, but producing a very characteristic appearance, shared with a specimen from Comana Vlasca, Romania (coll. A. Montandon, in d'Orchymont's collection). This appears to suggest that an undescribed species may be involved. However, the beetles concerned closely resemble *H. aquaticus* from Turkey and the Russian Transcaucasus — especially in their strongly granulate pronota. Further, study of *H. aquaticus* from further afield indicates that the variation in aedeagal size is greater than is suggested by the other Turkish and Iranian material. Thus a sample of 55 males from central Spain gave a range of aedeagophore lengths from 0.76-0.92 mm, from beetles 4.3-5.3 mm long. Although there is an increase in average length of aedeagophore with increasing beetle length, this is slight, and the longest aedeagophores were from beetles 4.5, 4.9 and 5.1 mm long. Two of the longest Spanish aedeagophores are shown in Figs 4 and 5. They show a variation in paramere shape found in Spanish *H. aquaticus*. French *H. aquaticus* show a similar range of aedeagophore length to the Spanish ones, but without the paramere form shown in Fig. 5. As shown by ANGUS (1982) the chromosomes of Spanish and French *H. aquaticus* are identical, and specimens from the two areas can be cross bred in the laboratory without ill effects. A series of 19 males from Nagorno Karabakh, Soviet Azerbaidjan, gave a range of aedeagophore length from 0.79-0.84 mm, similar to Turkish and Iranian material. Twelve males from the Leningrad district of northern Russia gave aedeagophore lengths of 0.75-0.80 mm — clearly smaller than Spanish and French material, and similar to specimens from Turkey (and Iran) and Azerbaidzhan. In all cases the range of beetle length was more or less the same. In 1982 I obtained chromosome preparations from Leningrad *H. aquaticus*, and found that the karyotypes were the same as Spanish and French ones, with the same form of B-chromosome as occurred in French

material. There is thus good reason to believe that the slight differences in aedeagophore size found in these samples are the product of local variation rather than of speciation.

The Turkish specimens with the long aedeagophores are 4.8-5.3 mm long — normal for *H. aquaticus*. As the shortest of these aedeagophores (0.94 mm long) is only 0.02 mm longer than the longest Spanish one (a difference of about 2%) I do not consider that there is adequate evidence for the recognition of a new species, but think it more likely that the specimens represent a local variant found along the shores of the Bosphorus. The Romanian specimen is 6 mm long, unusually large for male *H. aquaticus*. Its aedeagophore may indicate that it belongs to the same variant as the Bosphorus specimens, or may simply be a reflection of the large size of the beetle. These conclusions must be regarded as tentative, and investigation of the chromosomes of these large-aedeagophore forms is highly desirable.

The distribution of *H. aquaticus* is reviewed by ANGUS (1982), where the most south easterly records given are from the Russian Transcaucasus. The Iranian records are thus an extension to its known range. Further north, the most easterly record given by ANGUS (1982) is from Perm, in the Urals. This can also be extended a little to the east, as there are two specimens from near Tobolsk in Moscow University Museum.

H. syriacus Kuw.

TURKEY. Adana, 20 km N of Kozan, 500 m altitude, 5.V.1967, Besuchet. Antakya, Kişlak-Şenkoy, 800-850 m altitude, 2.V.1979, Besuchet-Löbl (G.). Karaçadag near Diyarbakir, 28.V.1987, Jäch (V.). S of Silvan, 29.V.1987, Jäch (V.). S of Islahiye, 100 km N of Antakya, 29.V.1987, Jäch (V.). Amanos Mts (= Gavur Daglari), 24.V.1987, Jäch (V.). Derik, W of Mardin, 950 m altitude, 8.V.1966 (V.).

IRAN. E. Azerbaijan: 31 km S of Ahar on the Tabriz road, 21.VI.1975, R. McCullers. Hamedan: Hamedan, 34°46'N, 48°27'E, Senglet (G.). Mazanderan: 22 km W of Robate Ghare Bil (labelled as Rabat-e-Ghabil), 37°19'N, 56°26'E, 31.V.1975, R. McCullers. Khorasan: 36 km S of Bidokht on the Birjand road, 34°12'N, 58°50'E, 8.VI.1975, R. McCullers (A long series).

H. syriacus is distributed from western Anatolia (where it apparently meets the the *H. maritimus* complex (ANGUS 1970a)), southwards to northern Israel (Haifa, Golan) and the Hedjaz coast of Saudi Arabia, eastwards to Iran, and in the USSR over Transcaucasia to southern Kazakhstan as far east as Samarkand and the Aksu-Dzhabagli nature reserve in the Talass Alatau southeast of Chimkent.

H. liguricus Angus

TURKEY. Ankara. Tokat (Paratypes). (Angus, 1970a).

Subgenus *Atractelophorus* Kuwert, 1886

Key to species: ANGUS 1985a. Additional species: ANGUS 1985b, 1985c, 1987.

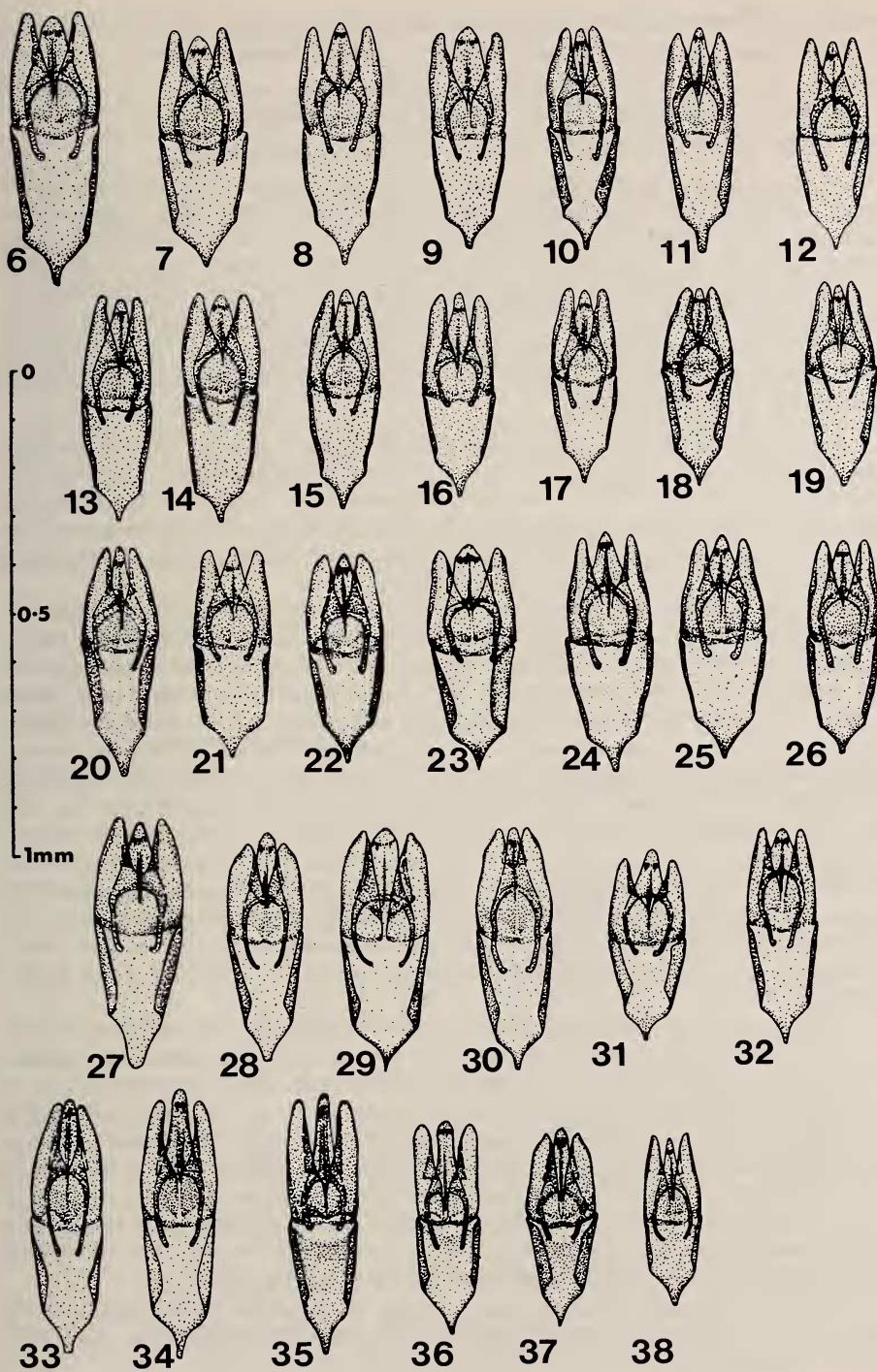
H. brevipalpis Bed.

As will be explained below, it is necessary to recognise two subspecies of *H. brevipalpis*: *H. b. brevipalpis* and *H. b. levantinus* n. subsp. In the following list of localities, material referable to *H. b. levantinus* is marked with an asterisk (*), while problematic or intermediate material is marked with a double asterisk (**).

- TURKEY. Kırklareli, 11 km SE of Demirköy, 31.VII.1969, Besuchet (G.). Istanbul, Altınşehir, 28.VII.1969, Besuchet (G.). Istanbul, Halkali near Istanbul, 3.VIII.1969, Besuchet (G.). Istanbul, Emirgân, 8.VII.1969, Besuchet (G.). Istanbul, Kilyos, 8.VII.1969, Besuchet (G.). 80 km W of Istanbul, 15.VI.1987, Jäch (V.). Ömerli E of Istanbul, 18.V.1987, Jäch (V.). Izmir, Bergama, 17.VII.1969, Besuchet (G.). Mugla, between Çetibeli and Marmaris, 7.V.1975, Besuchet-Löbl (G.). Antalya, Topraktepe, 200 m altitude, 8.V.1978, Besuchet-Löbl (G.). Bursa, S of Bursa, 23.VII.1969, Besuchet (G.). Bursa, Kaynarca near Izmit, 27.V.1967, Besuchet (G.). Ankara, 30-31.V.1947 (P.). Ankara region, IV.1925, Gadeau de Kerville. In coll. d'Orchymont, Brussels. Sinop, Lala near Sinop, 20.V.1978, Besuchet-Löbl (G.). Artvin, Furdikli, 14.V.1967, W. Wittmer (G.). Maraş, Maraş, 4.V.1978, Besuchet-Löbl (G.). Samsun, Çorşamba, 18.V.1967, Besuchet (G.). Mogan Gulu, Anatolia, 5.VII.1947 (P.). Ulukışla, Anatolia, 28.VII.1947 (P.). Between Sile and Agva, 19.V.1985, Jäch (V.). Tuz Gölü, 21.V.1987, 2 ♀ ♀, Jäch (V.). * Karacadag near Diyarbakir, 28.V.1987 (Jäch), (V.). ** Lake Van, east bank, 7.VI.1987, Jäch (V.). ** Between Van and Baskale, Guzeldere P. 2600 m, 5.VI.1987 (Jäch), 1 ♀ (V.).
- IRAN. W. Azerbaijan: Maku, 39°08'N, 44°30'E, 23.VI.1973, Senglet (G.). 15 km NW of Maku on the Pan-Asian road, 20.IX.1975, R. McCullers. E. Azerbaijan: 78 km N of Hero Abad (Khalkhal), 23.VI.1975, R. McCullers. Neur Lake, 35 air km ESE of Ardibil, 9.V.1975, R. McCullers. 59 km NW of Ardibil on the Meshkinshah road, 25.VI.1975, R. McCullers. 26 km S of Jolfa on the Marand road, 28.VI.1975, R. McCullers. Guilan: Hero Abad road altitude 1600 m, 37°38'N, 48°50'E, 10.VIII.1974, Senglet, 1 ♀ (G.). Nav's valley, 1800 m altitude, 3.VIII.1973, S. Vit., 1 ♀ (G.). Kordestan: E of Nyabad, 35°20'N, 46°39'E, 14.IX.1975, Senglet, 1 ♀ (G.). 14 km SW of Bijar, 18.VII.1975, R. McCullers, 2 ♀ ♀. Mazanderan: SSE of Gol-e-Loveh, 1200 m altitude, 37°18'N, 55°43'E, 21.VII.1975, Senglet (G.). Ivel, 1500 m altitude, 36°14'N, 56°37'E, 11.VII.1975, Senglet (G.). 21 km N of Ghalekesh, 37°08'N, 55°24'E, 29.V.1975, R. McCullers. «Hadji Nefes» (Khwaja Nafas, 37°01'N, 36°07'E), 15.III.1916, V. Il'in (In the Zoological Institute, Leningrad). ** 22 km W of Robate-Ghare Bil (labelled as Rabat-e-Ghabil), 37°19'N, 56°26'E, 31.V.1975, R. McCullers. Khorasan: * S of Bodjnour, 1700 m altitude, 37°20'N, 57°20'E, 19.VII.1975, Senglet (G.). * 36 km S of Bidokht on the Birjand road, 34°12'N, 58°50'E, 6.VI & 8.VI.1975, R. McCullers.

FIGS 6-38.

Helophorus spp., aedeagophores, traced from photographs. 6, 7, *H. brevipalpis levantinus*, paratypes from Khorasan (group 16); 8, 9, *H. brevipalpis* from Mazanderan, Robate-Ghare Bil (group 16); 10-23, *H. brevipalpis brevipalpis*, localities as follows: 10, 11, Odessa (group 9); 12, 13, Georgia, Bakuriani (group 10); 14, 15, E. & W. Azerbaijan (group 14); 16, Israel (group 8); 17, Corfu (group 6); 18, 19, Turkey (group 7); 20, 21, Avignon (group 3); 22, southern Finland; 23, Oxford, England (group 1); 24-26, *H. brevipalpis levantinus* (group 17); 24, holotype; 25, paratype from Yammouné, Lebanon; 26, paratype from Damascus, Syria; 27, *H. theryi* d'Orchymont; 28, 29, *H. difficilis* sp. n. — 28, holotype; 29, paratype from Baalbek, Lebanon; 30, *H. montenegrinus* Kuw. from Bakuriani, Georgia; 31, *H. yammounensis* sp. n., holotype; 32, *H. wroetae* sp. n., holotype; 33, 34, *H. ponticus* sp. n. — 33, holotype; 34, paratype from Lasistan; 35, *H. glacialis* Villa; 36, *H. abeillei* Guillebeau; 37, *H. maculatus* Motsch. from the Elburz; 38, *H. zagrosicus*, sp. n., holotype.



LEBANON. * Yammouné, streams at 1350 and 1360 m altitude, 15.III and 16.IV.1982, Z. Moubayed.

SYRIA. * Damascus, 30.XI.1932, A. Ball (In the d'Orchymont Collection, Brussels).

ISRAEL. Galilee, Golan heights and north Jordan Valley. Many specimens, mostly collected by M. Jäch (V.), but also by the Israel Ecological Survey and others.

IRAQ. * Bagdad, 1985, Al Salman leg. 1 ♀ (In coll. F. Hebauer, Deggenorf).

H. brevipalpis is very widely distributed in Europe, but apparently absent from north Africa — the reference to north african records by ANGUS (1970*b*, 1973) being based on misinterpretation of *H. gratus* d'Orchymont (shown to be a distinct species by ANGUS (1987)). In the east its range extends to Perm (central Urals, USSR), Transcaucasia, Iran and northern Israel. In North America it is known, almost certainly as an introduction, from the Logan district of Utah (ANGUS 1971*a*). The Utah population apparently consists entirely of females. SMETANA (1985) mentions having found a male, but he has very kindly sent this to me and it is in fact *H. orientalis* Motsch., despite the symmetrical apical segments of its maxillary palpi.

ANGUS (1985*a*) mentions that material collected by McCullers in Khorasan province, Iran, is unusual in the large size (up to 0.57 mm) of the aedeagophore. This feature is shared by the material collected in northern Khorasan by A. Senglet, by four of the five males taken by McCullers at Robate-Ghare Bil in Mazanderan, as well as specimens from Karaçadag (Diyarbakir) in Turkey and Yammouné in Lebanon, but not by Israeli specimens, which have conspicuously small aedeagophores.

Although different populations of *H. brevipalpis* may show marked variation in aedeagophore length, the aedeagophores are all basically similar in shape, with bluntly rounded apices to the parameres, and all the parts (parameres, basal piece, aedeagal tube and aedeagal struts) of moderate length (Figs 6-27). There are two apparently related species, *H. theryi* d'Orchymont, from the Atlas mountains, and *H. discretus* d'Orchymont, from the mountains of Soviet Central Asia, which resemble *H. brevipalpis* both in general form and in aedeagophore structure. *H. theryi* has the pronotum more strongly and evenly arched and more evenly rounded at the sides, than *H. brevipalpis* (Fig. 55), and the aedeagophore (Fig. 27) has the struts shorter than large *brevipalpis* aedeagophores. *H. discretus* is discussed by ANGUS (1985*a*). It is more elongate than most *H. brevipalpis*, and the aedeagophore is smaller than in the Khorasan specimens. Its geographical distribution is far from any known population of *brevipalpis*, and it need not be considered further here. The east Siberian *H. aspericollis* Angus is also readily separated from *brevipalpis* by its large aedeagophore, and is not relevant to the present discussion.

The problem presented by the populations still considered as *H. brevipalpis* is that they show considerable variation, much of it on a regional basis, and that there appears to be a rapid change from eastern Mediterranean forms with rather small aedeagophores to Lebanese and Iranian ones with conspicuously large ones. It is therefore necessary to analyse this variation in more detail, to see what patterns it shows. The populations show noticeable differences in average size and shape (robust or slender) (Figs 41-44), and in the pronotal shape — wider or narrower, more or less highly arched, with stronger or weaker granulation (Figs 50-54). However, these differences are slight, with considerable overlap between populations, and are not suitable for analysis. They are, however, helpful in moderating any conclusions which might be drawn from analysis.

Analysis of regional variation must therefore be based on measurements of the aedeagophore, and various parts of it, and on beetle length. Six measurements have been used, as follows:

1. Beetle length — from the front of the head to the apex of the elytra. Measurements were made using a binocular microscope, and allowance was made for variation in head position.

2-6, aedeagophore measurements, taken from photomicrographs.

2. Aedeagophore length — from a line joining the tips of the parameres to the basal tip of the basal piece.

3. Paramere length — from the tip of the paramere to base of its outer margin.

4. Basal piece length — from a line joining the apical ends of its lateral margins, to the basal tip.

Measurements 3 and 4 together do not always give the same value as measurement 2.

5. Aedeagal tube length — from the tip of the tube to its basal margin just beside the protrusion of the median basal spur. The spur is not included (see Figs 6-26).

6. Aedeagal strut length — from the basal point of measurement 5 to a line joining the basal (far) ends of the struts. Where the struts differed in their orientation, a point opposite the end of the strut which looked least displaced from its natural position was taken. No other attempt was made to compensate for variations in strut curvature, as this was felt likely to add subjective error, and in any case its effect on the measurement appeared small.

A total of 239♂♂ were measured, from localities selected to illustrate the most important regional variation. The material has been divided into 18 groups, as follows:

Group 1. Northwest Europe—Öland (Sweden), England and Belgium. 15♂♂.

Group 2. Perm (USSR). 12♂♂ in the d'Orchymont collection, all taken near Perm in August 1926 by A. Lubishev. A potentially very homogeneous sample.

Group 3. Avignon, France. 12♂♂, 9 from Avignon and 3 from Albaron.

Group 4. Spain. 15♂♂, from localities from Granada and Ronda in the south to Palencia in the north.

Group 5. Italy. 14♂♂, all from the d'Orchymont collection, from localities ranging from Calabria and Sicily in the south, to Sardinia and Bolzano in the north. The analysis (Table 2) does not show any regional variation within this sample.

Group 6. Greece. 12♂♂, mainly from Corfu (my collection), but including the lectotype of *H. creticus* Kies and one specimen from Morea.

Group 7. Turkey. 13♂♂. 9 from near Istanbul, 1 from Kirklareli, 1 from Sinop and 1 from Izmir. Western coastal localities, all listed above.

Group 8. Israel. 11♂♂. Golan and Galilee. (I have since seen many more specimens, all agreeing with the 11 used in general features).

Group 9. Odessa (USSR). 13♂♂ collected by me near Luzanovka on 8.IV.1970. A potentially very homogeneous sample.

Group 10. Alpine region of Georgia (USSR). 14♂♂ from Lake Tabitschuri and Bakuriani, in the Zaitzev collection (Leningrad).

Group 11. Tbilisi, Georgia, USSR. 15♂♂, some in the d'Orchymont collection and some in the Zaitzev. Material from a limited area at lower altitude than Group 10, but not far away.

Group 12. Central Anatolia. 10♂♂. 7 from Ankara and 3 from Antalya — placed together on aedeagophore size, and not separated into two groups by the analysis (Table 2).

Group 13. E Anatolia. East bank of Lake Van. 8♂♂. One sample.

Group 14. NW Iran. 9♂♂ from E and W Azerbaijan. Moderate altitude.

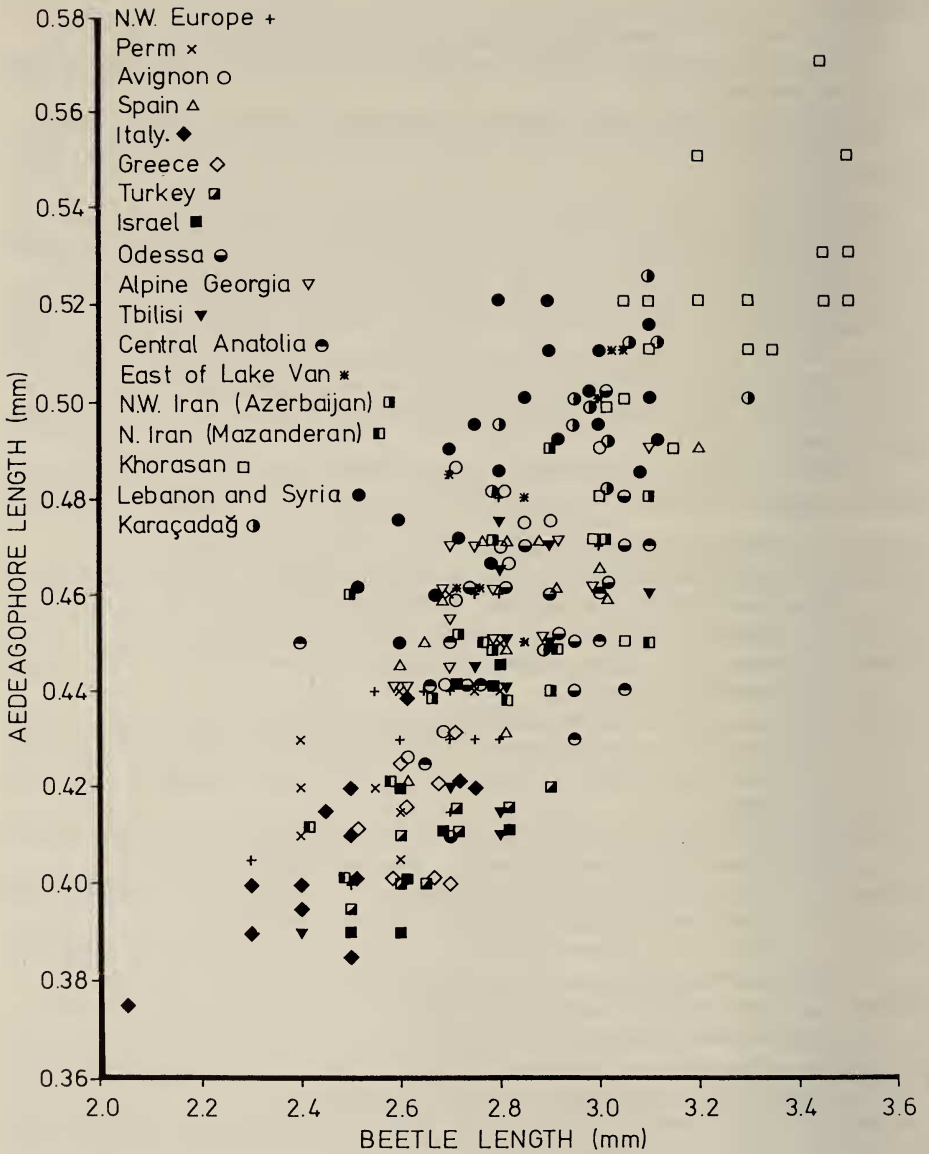


FIG. 39a.

H. brevipalpis, aedeagophore length plotted against beetle length.
Analysis groups as indicated in the key.

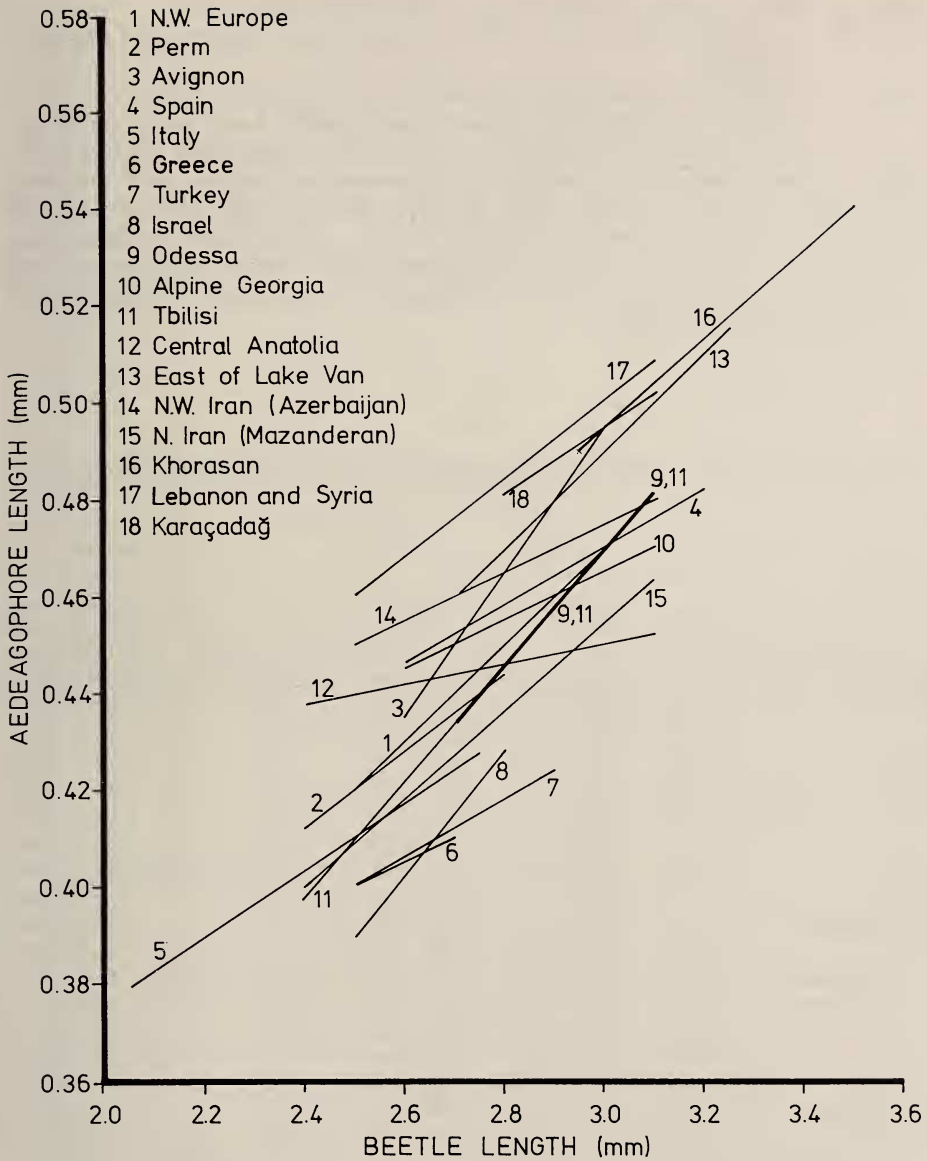


FIG. 39b.

H. brevipalpis, regression of aedeagophore length against beetle length plotted for the analysis groups. Groups indicated by numbers against the lines, lengths of the beetles indicated by the X-axis range given for each line.

Group 15. N Iran. 8♂♂ from Mazanderan, excluding Robate-Ghare Bil. Mainly low altitude.

Group 16. Iran. Khorasan and Mazanderan, Robate-Ghare Bil. 23♂♂.

Group 17. Lebanon and Syria. 23♂♂, 22 from Yammouné (Lebanon) and 1 from near Damascus.

Group 18. Turkey. Karaçadag near Diyarbakir. Leg. M. Jäch. 12♂♂.

Fig. 39a shows the aedeagophore length plotted against beetle length for all the specimens measured, while Fig. 39b shows the calculated regression lines for each of the groups — that for group 16 omitting the Mazanderan specimen with the small aedeagophore, though its inclusion makes very little difference. Fig. 39b shows that the eastern mediterranean populations (Groups 5-8) have strikingly small aedeagophores, while Groups 13, 16, 17 and 18 have noticeably large ones. However, examination of the individual plots in Fig. 39a shows that the situation is not so clear cut, with most groups showing considerable variation.

TABLE 1.

Helophorus brevipalpis, aedeagal tube length/strut length, basal piece length/paramere length

GROUP	Tube/struts			Basal piece/paramere		
	Mean	95% confidence limits	Observed range	Mean	95% confidence limits	Observed range
1. NW Europe	0.90	0.85–0.94	0.78–1.05	1.32	1.27–1.37	1.16–1.45
2. Perm	0.97	0.92–1.01	0.88–1.09	1.35	1.29–1.40	1.25–1.52
3. Avignon	0.97	0.91–1.03	0.81–1.12	1.33	1.27–1.38	1.15–1.41
4. Spain	0.91	0.88–0.94	0.88–1.00	1.29	1.25–1.32	1.19–1.43
5. Italy	0.89	0.85–0.93	0.78–1.00	1.22	1.17–1.28	1.05–1.44
6. Greece	0.87	0.82–0.91	0.74–1.00	1.26	1.20–1.32	1.19–1.53
7. Turkey	0.84	0.78–0.90	0.66–0.98	1.25	1.21–1.29	1.16–1.44
8. Israel	0.69	0.67–0.71	0.67–0.75	1.20	1.16–1.24	1.14–1.28
9. Odessa	1.00	0.95–1.05	0.89–1.20	1.23	1.17–1.30	1.00–1.37
10. Alpine Georgia	0.97	0.92–1.01	0.89–1.16	1.26	1.20–1.31	1.09–1.37
11. Tbilisi	0.89	0.86–0.92	0.79–0.96	1.15	1.11–1.20	0.95–1.36
12. Central Anatolia	0.88	0.81–0.95	0.71–1.04	1.26	1.22–1.30	1.19–1.37
13. L. Van, E. bank	1.06	0.99–1.13	1.00–1.23	1.31	1.24–1.38	1.17–1.42
14. NW Iran	0.95	0.86–1.04	0.80–1.20	1.28	1.23–1.35	1.18–1.38
15. N Iran	0.84	0.78–0.90	0.72–0.92	1.21	1.15–1.27	1.10–1.33
16. Khorasan	1.12	1.07–1.17	0.88–1.39	1.35	1.31–1.40	1.17–1.55
17. Lebanon & Syria	1.18	1.14–1.22	0.96–1.33	1.34	1.31–1.37	1.24–1.45
18. Karacadag	1.19	1.14–1.24	1.08–1.33	1.26	1.22–1.30	1.11–1.35

The relative lengths of the aedeagal tube and struts, and the parameres and basal piece, are most easily appreciated as proportions. They are shown (Table 1) as tube length divided by strut length and basal piece length divided by paramere length. The relative length of the struts is useful, and long struts show clearly by values greater than 1.0. This

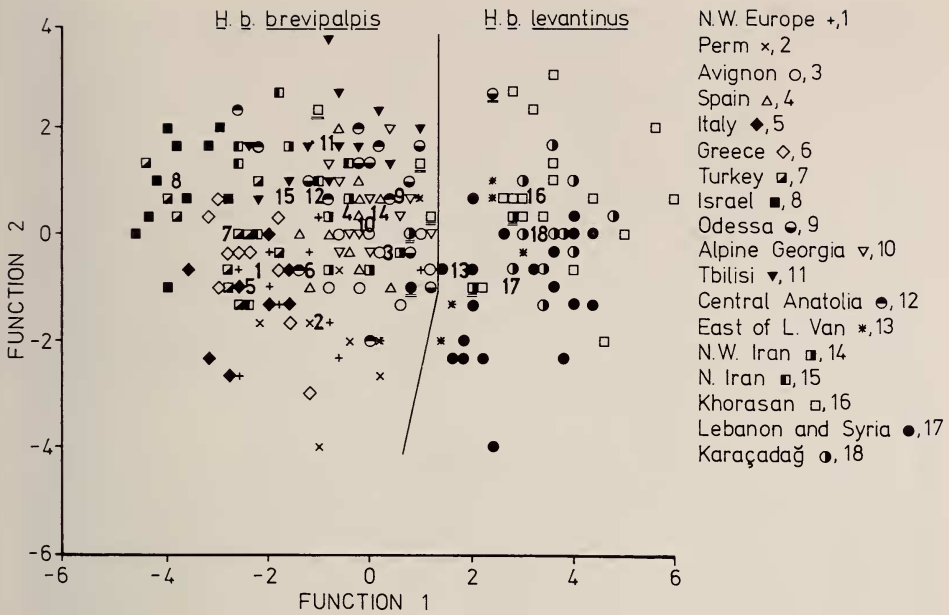


FIG. 40a.

H. brevipalpis. Computer generated scatter plot from the first two discriminant functions. Individual beetles plotted by the group symbols given in the key, group centroids by the group numbers. The division between *H. b. brevipalpis* and *H. b. levantinus* is indicated by the line. Group 13 (L. Van) occurs on both sides of the line. Specimens from other groups occurring on the "wrong" side of the line are indicated by double underlining (eg. ◐).

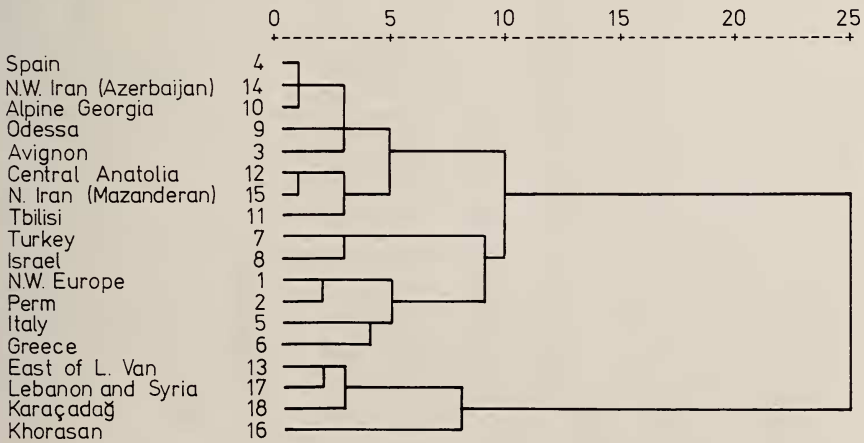


FIG. 40b.

H. brevipalpis, Dendrogram showing the relative distances between the "centroids" of the 18 groups used in the discriminant functions analysis. All six functions are used.

TABLE 2
H. brevipalpis. Group classification by Canonical Discriminant Functions

Actual Group	No. of cases	Predicted Group Membership																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
<i>Group 1</i> NW Europe	15	4 26.7%	3 20%	1 6.7%	2 13.3%	1 6.7%	2 13.3%	—	—	—	—	—	1 6.7%	—	1 6.7%	—	—	—	—	—
<i>Group 2</i> Perm	12	2 16.7%	6 50%	1 8.3%	1 8.3%	1 8.3%	1 8.3%	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Group 3</i> Avignon	12	—	1 8.3%	6 50%	2 16.7%	—	—	—	—	2 16.7%	1 8.3%	—	—	—	—	—	—	—	—	—
<i>Group 4</i> Spain	15	1 6.7%	—	1 6.7%	3 20%	—	1 6.7%	—	—	2 13.3%	—	1 6.7%	2 13.3%	—	4 26.7%	—	—	—	—	—
<i>Group 5</i> Italy	14	1 7.1%	—	—	1 7.1%	10 71.4%	1 7.1%	1 7.1%	—	—	—	—	—	—	—	—	—	—	—	—
<i>Group 6</i> Greece	12	1 8.3%	2 16.7%	—	—	—	4 33.3%	3 25%	1 8.3%	—	—	—	—	—	—	1 8.3%	—	—	—	—
<i>Group 7</i> Turkey	13	—	—	—	—	1 7.7%	3 23.1%	7 53.8%	2 15.4%	—	—	—	—	—	—	—	—	—	—	—
<i>Group 8</i> Israel	11	—	—	—	—	—	1 9.1%	—	10 90.9%	—	—	—	—	—	—	—	—	—	—	—
<i>Group 9</i> Odessa	13	—	—	1 7.7%	—	—	1 7.7%	—	—	6 46.2%	2 15.4%	1 7.7%	—	1 7.7%	—	—	—	—	1 7.7%	—

picks out Groups 13 and 16-18, with Group 9 (Odessa) a borderline case. Equally striking are the relatively short struts of Israeli specimens, a reflection in this case of both short struts and long tubes. The ranges shown by the various groups show considerable overlap. The values for basal piece and paramere lengths appear less useful and subject to greater individual variation.

The data have been further evaluated by a discriminant functions analysis. This shows that the most important features for separating the various samples are aedeagophore length, tube and strut lengths, beetle length and basal piece length. The first two functions account for 88% of the variance of the total sample.

Fig. 40a shows a computer generated scatter plot of the beetles and the "centroids" of the 18 groups, using the first two functions. The clearest feature of this plot is the separation of groups 16, 17 and 18 (subspecies *levantinus*) from the rest of the group, with group 13 spanning the separation, and very few beetles apart from group 13 appearing on the "wrong" side of the divide.

Fig. 40b shows a dendrogram based on the relative distances between the 18 group "centroids", using all six discriminant functions. This gives a very striking demonstration of the closeness of the three *levantinus* groups, and their distance from the other groups. However, such a plot must be treated with caution as it takes no account of the variation within the groups — which is why this plot places group 13 (E. bank of Lake Van) clearly within *levantinus*, whereas it is in fact intermediate — as shown in Fig. 40a.

The analysis has been further used to give calculated group membership to all the beetles, and the results of this are shown in Table 2. None of the groups appears entirely homogeneous in the light of these calculations, though group 8 (Israel) is very nearly so. This might be expected as this is geographically the most isolated group — but even here, the picture is less clear cut if the number of specimens from other groups that are assigned to Israel is taken into consideration.

One further feature worthy of note is the treatment of the East Mediterranean populations, characterised by their small aedeagophores (Fig. 39, *a* and *b*). These are groups 5-8. Table 2 shows that much of the redistribution of members of these groups is within this section, and it may be noted that this section is the one covered by *H. creticus* Kies. However, Fig. 40a shows that any separation of this group is very weak, while Fig. 40b places groups 1 and 2, the north European ones, in the middle of this section. The lectotype of *H. brevivalpis* is not included in the analysis, but would be in group 1. Thus, not only is the case for recognising a subspecies *creticus* very weak, but, in any event, *brevivalpis* itself would refer to this form.

Description of *Helophorus brevivalpis levantinus* subsp. n.

General appearance: Fig. 43 (Khorasan), Fig. 44 (Lebanon).

Head and pronotum: Fig. 52 (Khorasan), Figs 53 and 54 (Lebanon).

Aedeagophore: Figs 6, 7 (Khorasan), Figs 24, 25 (Lebanon), Fig. 26 (Syria).

Dimensions, given for the main populations included:

Lebanon, Yammouné. — Length: 2.5-3.0 mm (♂), 2.8-3.5 mm (♀); breadth: 1.1-1.3 mm (♂), 1.2-1.5 mm (♀).

Turkey, Karacadag near Diyarbakir. — Length: 2.8-3.2 mm (♂), 2.7-3.8 mm (♀); breadth: 1.2-1.3 mm (♂), 1.3-1.6 mm (♀).

Iran, Khorasan, Bodjnour. — Length: 3.0-3.3 mm (♂), 3.4-3.7 mm (♀); breadth: 1.3-1.4 mm (♂), 1.4-1.5 mm (♀).



41



42



43

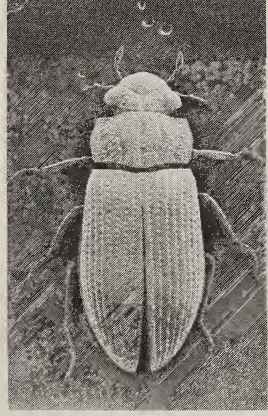


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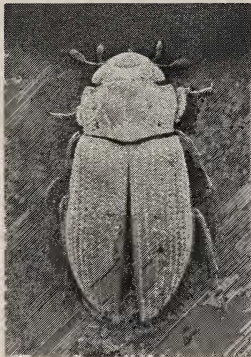
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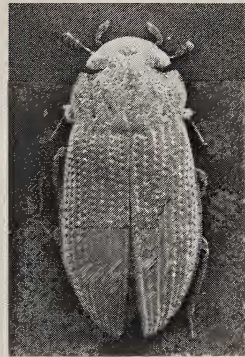
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FIGS 41-49.

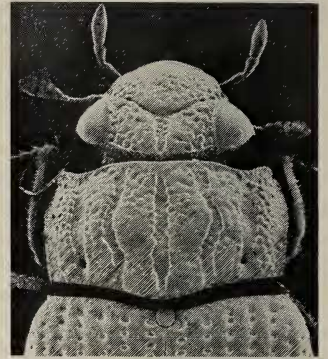
Helophorus spp. Scanning electron micrographs of whole beetles. 41, *H. brevipalpis brevipalpis* from Öland, Sweden (group 1); 42, *H. b. brevipalpis* from Odessa (group 9); 43, *H. b. levantinus* n. subsp., paratype from Khorasan 44, *H. b. levantinus* n. subsp., paratype (♀) from Yammouné, Lebanon; 45, *H. difficilis* sp. n., paratype; 46, *H. wrootae*, sp. n. paratype; 47, *H. ponticus* sp. n., paratype; 48, *H. zagrosicus* sp. n., paratype; 49, *H. yammounensis* sp. n., paratype.



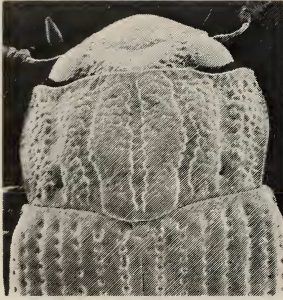
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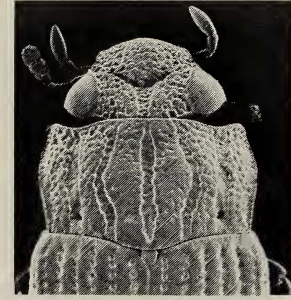
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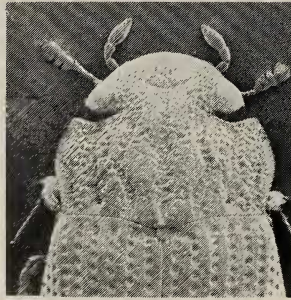
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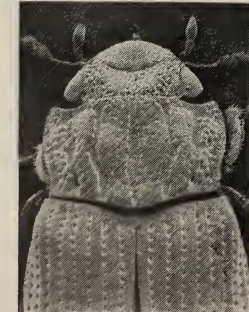
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58



59



60



61

1
mm

Iran, Khorasan, Bidokht. — Length: 2.9-3.5 mm (♂), 2.8-4.1 mm (♀); breadth: 1.2-1.5 mm (♂), 1.1-1.7 mm (♀).

H. brevipalpis levantinus is, in general characterised by its large size, often robust appearance, rather broad and often evenly arched and rounded pronotum, and above all by the aedeagophore. The aedeagophore is large (for *brevipalpis*), usually in the length range 0.48-0.52 mm, though occasionally as small as 0.45 mm, and as large as 0.57 mm (see Fig. 39a). The other characteristic feature of the aedeagophore is the long struts (Table 1).

Specimens from Lebanon and Karacadag have the pronotum normally rather evenly arched, strongly rounded at the sides, and frequently noticeably wide (Figs 53, 54), while in Khorasan material the pronotum is a little less evenly arched and the sides are a little straighter. Many specimens, especially those from Khorasan and Karacadag, are markedly robust, often with blunt elytral apices (Fig. 43), but in some, especially the larger females from Lebanon and Syria, the appearance is distinctly elongate, with more tapered elytral apices (Fig. 44).

The colouration is similar to that shown in normal *brevipalpis*, except that the ground colour of the pronotum is seldom green, but ranges from pitchy to maroon bronze or even golden.

Type material: Holotype ♂, LEBANON, Yammouné, stream at 1350 m altitude, 15.III.1982, Z. Moubayed. In the British Museum (Natural History), London.

Paratypes: 11 ♂♂, 4 ♀♀, 4 unsexed (genitalia missing), data as holotype; 13 ♂♂, 13 ♀♀, data as holotype, but altitude 1360 m, date 16.IV.1982. At present in my collection. 1 ♂, 2 ♀♀, SYRIA, Damascus, 30.XI.1932. A. Ball. In the d'Orchymont collection, Institut Royal des Sciences naturelles de Belgique, Brussels. 12 ♂♂, 14 ♀♀, TURKEY, Karaçadag near Diyarbakir, 28.V.1987. M. Jäch. In the Naturhistorisches Museum, Vienna. 1 ♀, IRAQ, Bagdad, 1987. Al Salman leg. In the collection of F. Hebauer (Deggenndorf). 6 ♂♂, 4 ♀♀, IRAN, Khorasan. S of Bodjnour, 1700 m altitude, 19.VII.1975. A. Senglet. In the Muséum d'Histoire naturelle, Geneva. 14 ♂♂, 12 ♀♀, Iran, Khorasan, 36 km S of Bidokht on the Birjand road, 8.VI.1975. R. McCullers. In my collection, 1 ♀, Iran, Khorasan. 23 km N of Soltanabad on the Pan Asian road, 10.VI.1975. R. McCullers. In my collection.

DISCUSSION

H. brevipalpis levantinus is a difficult taxon, partly because of the complicated nature of its interaction with normal *H. brevipalpis*, and partly because it appears to have a very disjunct distribution.

The taxon was originally recognised because the Lebanese material is obviously very different from the geographically closest population of normal *brevipalpis* — the “east Mediterranean” material from northern Israel. In the absence of the material from

FIGS 50-61.

Helophorus ssp. Scanning electron micrographs of heads and pronota. 50, *H. brevipalpis brevipalpis* from Oland, Sweden; 51, *H. b. brevipalpis* from Odessa; 52-54, *H. b. levantinus* n. subsp., paratypes; 52, from Khorasan; 53, 54, from Yammouné, Lebanon; 55, *H. theryi* d'Orchymont; 56, *H. difficilis* n. sp., paratype; 57, *H. yammounensis* sp. n., paratype; 58, *H. wrootae* sp. n., paratype; 59, *H. ponticus* sp. n., paratype; 60, *H. zagrosicus* sp. n., paratype; 61, *H. maculatus* Motsch. from the Elburz.

Karaçadag I had thought that *levantinus* was a separate species, closely related to *brevipalpis*. However, the Karaçadag material is, on the whole, so similar to that from Lebanon (and Syria) that it is not possible to distinguish the two, and the discriminant functions analysis (Fig. 40a) clearly shows that this Karaçadag material is also closely allied to that from Khorasan. At the same time, specimens taken by M. Jäch on the east bank of Lake Van (Turkish Kurdistan), include a few specimens inseparable from Karaçadag material, as well as some normal Anatolian *brevipalpis*. Other specimens are intermediate between the two extremes, with varying degrees of pronotal width and rounding of the sides, aedeagal length, and strut length. This population appears to represent a true mixing of *brevipalpis* and *levantinus*. The Lebanese material is geographically isolated from all other known populations, and this is perhaps the reason for its smaller size and sometimes less robust appearance.

The Khorasan populations (rather widely separated from one another) are very similar to each other, and should be linked geographically to material from south eastern Turkey by populations from northern and northwestern Iran. At first sight this is not the case, but further examination of the limited material available from this area shows that there appears to be a rather complex interaction between *levantinus* and *brevipalpis*. Five ♂♂ from Robate-Ghare Bil in eastern Mazanderan have been used in the numerical analysis as part of group 16 (Khorasan), as four of them appeared typical of that form (aedeagophore: Fig. 8), though the fifth is a normal Anatolian/Caspian *brevipalpis* (aedeagophore: Fig. 9). This population has been excluded from the type series of *levantinus* as it is probably intermediate between it and *brevipalpis*. Interestingly, the pronota of the "levantinus" specimens in this series are somewhat reminiscent of Karaçadag material, evenly arched and rounded at the sides. The rest of the material from this area includes specimens with hints of transition to *levantinus*, as well as others which do not — and this applies to both the aedeagophores (Figs 14, 15) and the general form. This is probably the reason for the marked heterogeneity of this material in discriminant functions analysis (Table 2, groups 14 and 15).

In conclusion, it seems that a subspecies of *brevipalpis* is the most appropriate status for *levantinus*.

One final point worthy of note is that with the exception of the Bagdad ♀, and possibly the Damascus material, all the *levantinus* records are from high ground.

***Helophorus difficilis* sp. n.**

General appearance: Fig. 45. Head and pronotum: Fig. 56. Aedeagophore: Figs 28, 29.

Length: 2.4-3.1 mm (♂), 2.4-3.5 mm (♀). Breadth: 1.0-1.3 mm (♂), 1.05-1.5 mm (♀).

Head: black with bronze reflections, moderately granulate, the granulation sometimes effaced near the Y-groove. Stem of Y-groove moderately deep, expanded anteriorly, its floor rugulose, dull golden bronze. Maxillary palpi dull yellowish, the apical segment symmetrical oval, darkened at tip. Antennae 9-segmented, dull yellowish, the clubs a little darker.

Pronotum: ground colour as head, with the anterior margin and marginal grooves dull yellowish. Widest at base of anterior third, the sides only weakly curved, the curvature even anteriorly, but the sides straightened or weakly sinuate posteriorly. Pronotum rather highly arched, flatter medially, but with the middle sections of the internal intervals

individually arched between the median and submedian grooves. Internal intervals punctate or with obsolete granulation medially, the granulation a little stronger towards the ends. Middle intervals weakly granulate, externals more strongly so. Mid groove rather shallow, fairly wide, sometimes tapered towards the ends, its floor either smooth, rugulose or pitted. Submedian grooves angled or curved outwards medially, recurved towards the ends, though not always anteriorly, their floors rugulose. Submarginals curved outwards medially, recurved posteriorly, widened and obsolescent anteriorly. Marginals even, obsolescent anteriorly, their floors rugulose. Raised lateral margins more or less smooth.

Elytra: dull yellow, with a dark sutural Λ -mark, and an extensive pattern of brown mottling. This mottling varies from being very pale, so the elytra appear yellowish, with the Λ -mark conspicuous, to much darker, so that the elytra are a dark mottled brown, with the sutural Λ -mark camouflaged in the general pattern, and with a pair of distinct pale subapical spots. The elytra are always rather paler and more mottled than is usual in *H. montenegrinus* Kuw. The elytral interstices are more or less flat, or weakly convex, the alternate interstices often more raised in the apical third. Apex tapered, flanks broadly visible from below.

Legs: fairly long, dull yellow with the apical tarsal segments darker towards the claws. Claws yellow.

Aedeagophore: distinguished from that of *H. brevipalpis* by the parameres, which are more robust, with the outer margins rather abruptly incurved just before the apex, then recurved to give a rather sharp apical point.

Holotype: σ , TURKEY, Antakya, Kişlak-Senköy, 800-850 m altitude, 2.V.1978, Besuchet-Löbl. In the Museum d'Histoire naturelle, Geneva.

Paratypes: 20 $\sigma\sigma$, 18 $\varnothing\varnothing$, data as holotype. 1 \varnothing , Antakya, 2.V.1978, Besuchet-Löbl. 1 \varnothing , Antakya, Habiye, 3.V.1978, Besuchet-Löbl. 1 \varnothing , Antakya, Sogukoluk, 700 m altitude, 3.V.1978, Besuchet-Löbl. In the Museum d'Histoire naturelle, Geneva. 13 $\sigma\sigma$, 3 $\varnothing\varnothing$, S of Islahiye, 100 km N of Antakya, 26.V.1987. M. Jäch. 12 $\sigma\sigma$, 6 $\varnothing\varnothing$, W of Kilis, 26.V.1987, M. Jäch, 6 $\sigma\sigma$, 7 $\varnothing\varnothing$, Amanos Mts (= Gavur Daglari), 24.V.1987. M. Jäch. 1 σ , 1 \varnothing , streams E of Osmaniye, 24.V.1987. M. Jäch. In the Naturhistorisches Museum, Vienna, 1 σ , LEBANON, Baalbek, station 6, altitude 1150 m, 12.V.1982. Z. Moubayed. In my collection. 1 σ , Beirut, 1878. In the d'Orchymont collection, Institut Royal des Sciences naturelles de Belgique, Brussels. 1 σ , ISRAEL, Golan, N Meitsar/elion, 1.IV.1985. M. Jäch. 1 σ , Golan. Mt. Hermon, 20.IV.1981, G. Wewalka. In the Naturhistorisches Museum, Vienna.

H. difficilis closely resembles darker specimens of *H. brevipalpis*, from which it is reliably, and very clearly, separated only by the form of the parameres. Most *H. brevipalpis* are paler in colour, with the head and pronotum greenish or bronze, the latter with clear yellow anterior and lateral margins. In *H. brevipalpis* the pronotal sides are generally more rounded. *H. montenegrinus* is darker than *H. difficilis*, with dark brown, often somewhat bronzed, maxillary palpi, and without paler anterior and lateral margins to the pronotum. The aedeagophore (Fig. 30) is also different, with longer parameres.

H. difficilis is apparently confined to the extreme eastern end of the Mediterranean.

H. montenegrinus Kuw.

TURKEY. Kirklareli. Between Yeniceköy and Demirköy, 31.VII.1969, Besuchet (G.). Istanbul. Forest of Belgrade, 4.VI.1967 & 10.VII.1969, Besuchet (G.). Istanbul. Forest of Tasdelen. Near Sile, 28.V.1967, Besuchet (G.). Istanbul. Kilyos, 8.VII.1969, Besuchet

(G.). 80 km W of Istanbul, 15.VI.1987, Jäch (V.). Ömerli E of Istanbul, 15.VI.1987, Jäch (V.). Bursa. S of Bursa, 23.VII.1969, Besuchet (G.). Bolu. Between Bolu and Yeniçaga, 1000 m altitude, 24.V.1967, Besuchet (G.). Bolu. Ömerler near Bolu. 800 m altitude, 21.V.1976, Besuchet-Löbl (G.). Bolu. Elmalik near Bolu. 250 m altitude, 25.V.1967, Besuchet (G.). Bolu. Abat. 1500-1600 m altitude, 22.V.1976, Besuchet-Löbl (G.). Bolu. Between Duzce and Akcakoca, 26.V.1967, Besuchet (G.). Kastamanu, 5 km N of Kure, 600 m altitude, 18.V.1976, Besuchet-Löbl (G.). Between Sile and Agva, 19.V.1987, Jäch (V.). Ankara. Baraj. Anat, 3-4.VII.1947 (P.). Sinop. Lala near Sinop, 20.V.1976, Besuchet-Löbl (G.). Sinop. S of Bektras, 23 km N of Boyabat, 1100 m altitude, 20.V.1976, Besuchet-Löbl (G.). Trabzon. Soumela Meriemana, 1000-1600 m altitude, 12-14.VI.1969, leg. Osella (G.). Yenihoy Toros. Anat, 30.VIII.1947 (P.).

USSR. Georgia. Bakuriani, dist. Gori, 5500 ft altitude, VII.1914, Zaitzev. In the Zaitzev collection, Zoological Institute, Leningrad.

These records apparently represent the eastern limits of the distribution of *H. montenegrinus*. The record from the Caucasus is based on a single ♂, whose aedeagophore is shown in Fig. 30. The beetle is small, length 2.4 mm, so that the aedeagophore is very clearly *montenegrinus*. There are probably one or two ♀♀ *montenegrinus* from the same area in Zaitzev's collection, but all his other material, including a ♂ from 6000 ft altitude near Bakuriani, is *brevipalpis*. ZAITZEV (1946) records *H. montenegrinus* as uncommon in the alpine zone of the Caucasus, and adds that it is darker than typical *brevipalpis*, which it replaces at high altitude. He regarded the two as intergrading, and regarded them as climatically separated subspecies. ANGUS (1985a) showed that *brevipalpis* and *montenegrinus* must be regarded as separate species, and that they do not intergrade. However, I was at that time unaware that Zaitzev's collection did contain true *montenegrinus* from the Caucasus as when I worked through the material in 1969 I overlooked the specimen among the numerous *brevipalpis*. I take this opportunity of setting the record straight!

***Helophorus yammounensis* sp. n.**

General appearance: Fig. 49. Head and pronotum: Fig. 57. Aedeagophore: Fig. 31. Length: 2.4-2.9 mm (♂), 2.8-3.5 mm (♀). Breadth: 1.1-1.3 mm (♂), 1.2-1.5 mm (♀).

Head: pitchy with maroon and greenish bronze reflections. Surface granulate, the granulation reduced towards the stem of the Y-groove. Stem of Y-groove expanded anteriorly, its floor with small tubercles. Arms of Y-groove very narrow, obsolete laterally. Maxillary palpi yellow, rather short, the apical segment a symmetrical deep bellied oval. Antennae yellow, 9-segmented.

Pronotum: ground colour as head, with the anterior margin and marginal grooves yellow. Moderately arched, widest a third of the way from the anterior margin, the sides evenly curved anteriorly, but recurved a quarter of the way from the hind angles. All intervals closely and irregularly granulate, except for the middle and posterior sections of the internal intervals, where the sculpture is reduced to impressed rings round median punctures. Mid groove straight, tapered to the ends, its floor with irregularly placed small raised tubercles. Submedian grooves narrower than the mid groove, angled outwards medially, recurved about a quarter of the way from each end, their floors bearing a single row of small raised tubercles. Submarginals wider, almost straight and almost parallel,

their floors with irregularly arranged tubercles. Marginals fairly wide, their inner edges irregular, their floors with irregularly arranged tubercles. Raised lateral margins finely but distinctly serrate.

Elytra: striae of deep rather large punctures, about two thirds the width of the interstices. Interstices flat, sometimes rugulose. Ground colour mid to dark brown, with the dark sutural Λ -mark distinct, and also dark marks anterior and antero-lateral to the sutural mark, leaving irregular paler humeral, lateral and apical areas.

Legs: moderately long, dull yellow.

Aedeagophore: very similar to that of *H. brevipalpis*, but at the small end of the size range.

Holotype: σ . LEBANON, Yammouné, stream at 1360 m altitude, 16.IV.1982, Z. Moubayed. In the British Museum (Natural History), London.

Paratypes: 1 σ with the aedeagophore broken off. Data as holotype. In my collection. 2 unsexed, lacking the end of the abdomen. LEBANON, Yammouné, stream at 1350 m altitude, 11.IX.1980, Z. Moubayed. In my collection and the Museum d'Histoire naturelle, Geneva. 1 φ , «J'ai Va, Syria» (probably Jaffa, ISRAEL, teste M. Jäch in litt., 14.IV.1987). In the d'Orchymont collection, Institut royal des Sciences naturelles de Belgique, Brussels. 1 σ , N Israel, N Dan River, 2.VII.1985. Collection IES 4510. 1 φ , N Israel, N Dan River, 30.V.1983, 2 $\sigma\sigma$, Israel, Ein Nimrod, Junction No. 2, 8.VII.1987, R. Ortal. Collection IES 5117. In the Zoology Department, Hebrew University of Jerusalem.

This is a highly distinctive species, clearly identified by the presence of tubercles in all the pronotal grooves, the recurved pronotal sides and the pale anterior and lateral margins of the pronotum. Other *Atracthelophorus* species may have a single row of tubercles in the pronotal submedian grooves (*H. dalmatinus* Gangl., *H. daedalus* d'Orch., and *H. leontis* Angus), but in these species the tubercles are confined to the submedian grooves, and the pronotal sides are evenly rounded, and the anterior and lateral margins are dark. In its rather robust shape, and the shape of the pronotum, *H. yammounensis* resembles *H. pictus* Gangl., from the mountains of Middle Asia (Buchara), but that species has shallower pronotal grooves whose floors may be pitted or rugulose, but not tuberculate.

H. daedalus d'Orchymont

TURKEY, Izmir, Bahçeliköy, 16.VII.1969, Besuchet (G.). Izmir, Bergama, 17.VII.1969, Besuchet (G.). Çamildere, Issik dag, 23.VI.1947 (P.). Diyarbakir, Karaçadag, 1850 m altitude, 7.IV.1983, 14.IV.1983, 15.IV.1983, 4.VI.1983, N. Lodos (Izmir). E of Diyarbakir, 29.V.1987, Jäch (V.). W of Cizre, 30.V.1987, Jäch (V.). Bismil E of Diyarbakir, 29.V.1987, Jäch (V.). Small stream 25 km W of Şemdinli, 3.VI.1987, Jäch (V.). Hizan S of Lake Van, 8.VI.1987, Jäch (V.). Kaimak, 26.VII.1910 (V.). Sarseng, Pietschmann, 1910 (V.). Cat. distr. Erzerum, coll. Zaitzev (Leningrad). Khnys-Kaba, coll. Zaitzev (Leningrad).

IRAN. Kordestan: E of Marivan, 35°32'N, 46°20'E, 16.IX.1975. Senglet, 1 σ (G.). SE of Kal'eh Dju, 35°19'N, 46°20'E, 14.IX.1975, Senglet, 2 $\varphi\varphi$ (G.). Sheikh Ata, 35°30'N, 46°28'E, 16.IX.1975, Senglet, 1 σ , 1 φ , 3 unsexed (G.).

H. daedalus was described from near Izmir, and all records up till now have been from Anatolia, where, as may be seen, it is very widely distributed. The Iranian material represents an important extension to its known range.

H. daedalus is one of three known species in which the pronotal submedian grooves have a single row of small raised tubercles but the other grooves are not tuberculate. It is more robust than *H. dalmatinus* Ganglbauer, from Yugoslavia, and *H. leontis* Angus, from Spain, and the aedeagophore is distinctive in all three (ANGUS 1985a). More recently, a subspecies of *H. leontis* (*H. l. dixoni* Angus, 1987) has been discovered in northern Israel. Although the aedeagophore of this subspecies is identical with that of the type form, the beetles are clearly more robust, and hence liable to confusion with *H. daedalus*. The type material of *H. daedalus* is teneral, and it is only now that I have seen fully hardened material. This material shows that the elytra of *H. daedalus* have indistinct paler subhumeral and subapical marks on the elytra (as in *H. montenegrinus*), and these patches, as well as the form of the aedeagophore, should permit the separation of *H. daedalus* and *H. leontis dixoni*.

***Helophorus ponticus* sp. n.**

General appearance: Fig. 47. Head and pronotum: Fig. 59. Aedeagophore: Figs 33, 34.

Length: 2.9-3.1 mm (♂). Breadth: 1.2-1.3 mm (♂).

Head: shining black with maroon bronze reflections, the surface mainly punctate, granulate only by the eyes and on the clypeus. Stem of Y-groove either subparallel or expanded anteriorly, its floor either smooth or with small tubercles, dull golden bronze. Maxillary palpi black with maroon or golden bronze reflections, the apical segment symmetrical oval. Antennae 9-segmented, dark brown, the clubs darker.

Pronotum: ground colour as head, moderately arched, flatter over the internal intervals. Internal and middle intervals punctate, the latter with impressed rings round the punctures towards the outer sides. External intervals granulate. Grooves shallow, their floors smooth. Mid groove rather narrow, tapered to the ends. Submedians narrower, angled or curved outwards medially, recurved near ends. Submarginals weakly curved to almost straight, subparallel. Marginals shallow, narrow. Raised margins distinct. The pronotum is widest at the base of the anterior third, with the sides evenly curved anteriorly, straightened posteriorly.

Elytra: black with maroon bronze reflections, very slightly paler laterally. Elongate but not parallel sided — the widest point is a third of the way from the apex. Apex tapered then bluntly rounded. Surface with a V-shaped impression about a third of the way from the base, extending laterally as far as interstice 4. Striae of shallow but bold punctures, about half the width of the interstices. Interstices almost flat, rugulose, becoming weakly convex in apical third. Flanks broadly visible from below.

Legs: long and slender, maroon bronze or black, the tarsi a little paler.

Aedeagophore: parameres elongate, tapering. Tube and struts both moderately long — giving a clear separation from *H. glacialis* Villa, in which the tube is very long, the struts very short (Figs 33-35).

Holotype: ♂, TURKEY, Lasistan. Kackar, 3300 m altitude. On the snow, 8.VIII.1969, leg. H. Gall. In the Museum d'Histoire naturelle, Geneva.

Paratypes: 1 ♂, data as holotype; 1 ♂, Turkey, Kars. South of Damal, 2050 m altitude, 13.VI.1986, Besuchet-Löbl-Burckhardt. In the Museum d'Histoire naturelle, Geneva.

This species is very similar to *H. glacialis*, though darker and a little more robust than in some specimens. The aedeagal separation is very clear (Figs 33-35), but I can find no other clear distinction between the two.

H. ponticus or **H. glacialis** Villa

TURKEY. Bursa. S of Uludag, 900-2000 m, 12.V.1976. Besuchet-Löbl, 1 ♀ (G.).

This locality is almost equidistant from the most eastern records for *H. glacialis* (Bulgaria, Rhilo Dag; Greece, Mt-Olympus) and the east Anatolian localities for *H. ponticus*. Males from this region would be very useful.

H. faustianus Sharp

TURKEY. Tokat, IX.1924. Dr Vasvari, 1 ♂. In the Hungarian Natural History Museum, Budapest. All other records for this species are from the Caucasus.

H. abeillei Guilleb.

TURKEY. Yenihöy, Toros. Anat., 30.VIII.1947, 5 ♂♂, 4 ♀♀ (P.). Asia Minor. Lycia: Elmali. Spring at 1200 m altitude, 27-28.VI.1933. D'Orchymont, 1 ♂, 1 ♀. Coll. d'Orchymont, Brussels. (Originally standing as *H. glacialis*.) Small stream 25 km W of Semdinli, 3.VI.1987, Jäch, 1 ♂ (V.). Between Van and Baskale, 2600 m, Güzeldere P., 5.VI.1987, Jäch, 1 ♂ (V.). 60 km SE of Tatvan, 8.VI.1987, Jäch, 9 ♂♂, 11 ♀♀ (V.). S of Yükeşekova, 4.VI.1987, Jäch, 2 ♂♂, 2 ♀♀ (V.). Kozik, Erzerum district, 1 ♂, coll. Zaitzev, Leningrad. ? Kars, S of Karakurt, 1900 m altitude, 17.VI.1986, Besuchet-Löbl-Burckhardt, 1 ♀ (G.): I cannot tell whether this is *H. abeillei* or *H. maculatus* Motsch. The apical segments of the maxillary palpi are particularly wide — a character noted in the type of *maculatus*. The specimen is listed under *abeillei* as the Kozik ♂ is the nearest sure record for either species.

IRAN. Mazanderan: Ivel, 1500 m altitude, 36°14'N, 53°37'E, 11.VII.1975, Senglet, 1 ♂ (G.). ?Kordestan: Hoseynabad, 35°33'N, 47°08'E, 17.IX.1975, Senglet, 1 ♀ (G.). Tehran: Polur, 2300 m altitude, 35°51'N, 52°04'E, 17.VII.1973, Senglet, 1 ♂ (G.). Kermanshah: Kangavar, 34°29'N, 47°55'E, 1.VIII.1973, Senglet, 1 ♂ (G.). Kohkiluyeh: Yasudj road, 2200 m altitude, 30°32'N, 51°32'E, 27.V.1974, Senglet, 2 ♀♀ (G.). Identified on the strength of the Fars record (below), and because *H. maculatus* is apparently replaced in the Zagros mountains by *H. zagrosicus* sp. n. (q. v.). Fars: Loc. 245, 29 km E of Yasudj, 10 km NW of Karum, 2300 m altitude, 30°41'N, 51°43'E, 16-17.VI.1973. By sweeping vegetation in a mountain valley with a brook, 1 ♂ (P.).

H. maculatus Motsch

TURKEY. Between Van and Baskale, 2600 m, Güzeldere P., 5.VI.1987, Jäch, 8 ♂♂, 12 ♀♀ (V.).

IRAN. Tehran: N of Kendvan, 2700 m altitude, 36°10'N, 51°19'E, 12.VII.1973, Senglet, 1 ♂, 4 ♀♀ (G.). S of Dizine, 3500 m altitude, 36°03'N, 51°25'E, 13.VII.1973, Senglet, 4 ♀♀ (G.). Pol-e-Zanguleh, 2300 m altitude, 36°13'N, 51°19'E, 12.VII.1973, Senglet, 1 ♀ (G.). Central Elburz, Kandvan (Kendvan) pass, 3000 m altitude, 36°07'N, 51°19'E, 11.VIII.1970, 1 ♂, 4 ♀♀ (P.). Central Elburz, Kuhhache Tochal, 3000-3400 m altitude, 35°53'N, 51°25'E, 18-19.VII.1970, 2 ♀♀ (P.). All records for ♀♀ only are based on ♂♂ for neighboring localities.

As explained by ANGUS (1985a) *H. maculatus* and *H. abeillei* can be reliably separated only on the basis of the aedeagophore (Figs 36, 37). Nevertheless, the material listed here suggests that *H. maculatus* tends to be found at higher altitudes than *H. abeillei*. *H. abeillei* was described from Mt. Hermon, and it ranges from Lebanon, over Anatolia and Iran as listed above, and occurs in Transcaucasia. *H. maculatus* was described from Arganety, the highest point south of the headwaters of the R. Ischim in

Kazakhstan, and only one ♀ type exists. Otherwise, its distribution is as listed above, plus Soviet Armenia (Coll. S. M. Khnzorian, Erevan), and the Araxes (Araks) valley in Soviet Azerbaïdzhan (2♂♂ in the Reitter collection, Budapest).

***Helophorus zagrosicus* sp. n.**

General appearance: Fig. 48. Head and pronotum: Fig. 60. Aedeagophore: Fig. 38. Length: 2.2-2.6 mm (♂), 2.4-2.6 mm (♀). Breadth: 0.85-1.1 mm (♂), 1.0-1.1 mm (♀).

Head: dark maroon bronze with dull green reflections, the surface granulate, becoming punctate near the stem of the Y-groove. Stem of Y-groove rather long, expanded anteriorly, its floor rugose, dull greenish bronze. Maxillary palpi very dark pitchy, with maroon and greenish bronze reflections, the apical segment symmetrical oval, rather wide. Antennae 9-segmented, pitchy, the clubs darker.

Pronotum: ground colour black with maroon or green bronze reflections. Widest at base of anterior third, the sides curved anteriorly, straightened posteriorly, slightly recurved a quarter of the way from the base. Highly arched laterally, but flat over the internal intervals. Internal intervals punctate, sometimes weakly granulate towards the ends. Middle intervals punctate to granulate, externals strongly granulate. Grooves moderate to shallow, dull golden bronze. Mid groove straight, tapered to the ends, its floor rugulose. Submedians narrower, angled or curved outwards medially, recurved near ends. Submarginals almost straight, slightly divergent anteriorly, rather wider than submedians. Marginals fairly wide, clear to the hind angles and almost to the anterior margins, rugulose. Raised lateral margins very finely crenulate.

Elytra: dull yellow, extensively mottled with greyish brown, the sutural Λ -mark darker. Parallel sided to apical third, then tapered. Striae of large shallow punctures, three quarters to half the width of the interstices. Interstices flat. Flanks broadly visible from below.

Legs: rather short, dull yellowish to pitchy with faint bronze reflections.

Aedeagophore: Slightly smaller than that of *H. maculatus* (Figs 37, 38), and with the parameres narrower and more tapered.

Holotype: ♂, IRAN, Bakhtiari, NE Zardeh-Kuh, 2700 m altitude, 32°23'N, 50°07'E, 20.VI.1974, A. Senglet. In the Museum d'Histoire naturelle, Geneva.

Paratypes: 3♂♂, 1♀, data as holotype; 2♀♀, Iran, Bakhtiari, Kuhrang, 2700 m altitude, 32°29'N, 50°04'E, 9.VII.1973, A. Senglet. In the Museum d'Histoire naturelle, Geneva, 1♂, 1♀, Iran, Central Elburz, Kandvan pass, 3000 m altitude, 36°07'N, 51°19'E, 11.VIII.1970. In the National Museum of Natural History, Prague. 1, unsexed (lacking the end of the abdomen), Iran, Central Elburz, Damavand, east, 3850 m altitude, 35°56'M, 52°08'E, 22.VII.1970. In the National Museum of Natural History, Prague, 1♂, 1♀, TURKEY, SE Anatolia, NE of Yüskokova, 2100 m altitude, 37°30'N, 44°15'E, 20.VIII.1970. In the National Museum of Natural History, Prague.

H. zagrosicus is most similar to *H. maculatus* and *H. abeillei*, but is on the whole noticeably smaller than both. This is particularly true of specimens from the Zagros mountains. The pronotum is characteristic, with the sides more strongly recurved in front of the hind angles, and the arching less even — flatter medially and steeper at the sides (Figs 60, 61). The aedeagophore is characteristic, less robust than in *H. maculatus*, but with the parameres tapering apically, not parallel-sided, as in *H. abeillei* (Figs 36-38). The aedeagophore is most like that of *H. longipennis* Ganglbauer in shape (ANGUS 1984,

Fig. 70), but markedly smaller. *H. longipennis*, from the mountains of Soviet Central Asia (Middle Asia) is larger (length 2.7-3.8 mm) and much more elongate (ANGUS 1984, Fig. 161).

It should be noted that *H. zagrosicus* and *H. maculatus* occur together in the Central Elburz, and that in the absence of males from the type locality of *H. maculatus* (Kazakhstan), the present interpretation of *H. maculatus* must be regarded as tentative.

Helophorus wrootae sp. n.

General appearance: Fig. 46. Head and pronotum: Fig. 58. Aedeagophore: Fig. 32.

Length: 2.5-2.8 mm (♂), 2.5-3.1 mm (♀). Breadth: 1.0-1.2 mm (♂), 1.05-1.3 mm (♀).

Head: pitchy bronze, rather strongly granulate, the granulation sometimes reduced towards the stem of the Y-groove. Stem of Y-groove expanded anteriorly, its floor rugose, dull golden bronze. Maxillary palpi mid brown with bronze reflections, the apical segment symmetrical oval, darkened at the tip. Antennae 9-segmented, brown.

Pronotum: highly and very evenly arched, widest just before the middle, the sides evenly curved, sometimes straighter basally. Ground colour as head, without paler anterior and lateral margins. All intervals closely granulate, the granulation sometimes weaker on the middle of the internal intervals. Grooves shallow, fairly narrow, their floors sometimes dull brassy. Mid groove straight, generally tapered to the ends, its floor smooth or pitted. Submedians curved or weakly angled outwards medially, usually recurved a third of the way from each end, their floors often with a row of pits. Submarginals weakly curved outwards medially, not divergent anteriorly. Marginal grooves even, sometimes narrowed at hind angles. Raised lateral margins distinct, very finely crenulate.

Elytra: dark brown to dull yellowish brown. Paler specimens have the dark sutural A-mark distinct, as well as an extensive pattern of darker mottling and dark marks on interstice 6. Striae moderate, about two thirds the width of the interstices, the interstices weakly convex. Elytra widening from shoulders to just behind the middle, tapered to apex. Flanks broadly visible from below.

Legs: moderately long, dull yellowish brown, often with the outer part of the apical segment (but not the claws) darker.

Aedeagophore: parameres more tapered and more evenly curved than in *H. brevipalpis*, and struts longer than in most *brevipalpis*, especially the smaller ones. Struts much longer than in the Spanish *H. bameuli* Angus.

Holotype: ♂, CORFU, R. B. Angus, 9-20.IV.1986, Val de Ropa, Winter ditches. In the British Museum (Natural History), London.

Paratypes: Corfu, R. B. Angus, 9-20.IV.1986. Details as follows: 5♂♂, 5♀♀, data as holotype; 6♂♂, 3♀♀, Marshy pool N of the Palaeocastritsa road, SE of Dukades; 3♂♂, 7♀♀, lake 2 km E of Temploni (W of the Danilia Folklore Village); 2♂♂, 4♀♀, pools and marsh behind the dunes, Linia; 1♂, 1♀, lake near Agios Ioannis, beside the road from Corfu town to Ermones. In addition to these, the d'Orchymont collection (Brussels) has 1♀ with the data: Kerkyra (Corfu), Valle Ropa, 23.IV.1930, A. d'Orchymont. The paratypes which I collected are in the Museum d'Histoire naturelle, Geneva, the British Museum (Natural History), London, the Zoological Institute, Leningrad, and in my collection.

This species is named after Mrs Sarah Wroot, in appreciation of the many *Helophorus* drawings she has done for me.

H. wrootae is one of the *Atracthelophorus* species with brown (as against metallic black) maxillary palpi, without a pale anterior border to the pronotum, and with the ely-

tral striae clearly narrower than the interstices. Its highly arched, granulate pronotum, with evenly rounded sides, separates it from all species in this group except the northern Spanish *H. bameuli* Angus. *H. wrootae* is more robust than *bameuli*, and has the elytral apex more tapered. The aedeagophore has much longer struts, and the outer margins of the parameres are more evenly curved.

It is a surprise to find an unknown species of *Helophorus* so abundant in such a relatively well-known place as Corfu. I took it in nearly all the still water localities I worked, and have about twice as much material as of *H. brevipalpis*.

It may be that it is a winter and spring species, though in that case it is still surprising that d'Orchymont took only 1 ♀ among 20 *H. brevipalpis* collected in April.

H. lewisi Angus

TURKEY. Antakya, Kışlak Senköy, 800-850 m altitude, 2.V.1978, Besuchet-Löbl, 2♂♂ (G.). Diyarbakir, Karaçadag, 1850 m altitude, 3.IV.1983, 14.IV.1983, 20.IV.1983, N. Lodos (Izmir). A good series, ♂♂, ♀♀. Karaçadag near Diyarbakir, 28.V.1987, Jäch, 1♂ (V.). SE Turkey, 5 km W of Sirkak, 31.V.1987, Jäch, 1♂ (V.). Gümüşhane. Between Erzincan and Kelkit, 2100 m altitude, 4.VI.1986, Besuchet-Löbl-Burckhardt, 4♂♂ (G.).

ISRAEL. Golan: Gamla Springs. Coll. Israel Ecological Survey, 1♀. Golan, Qusbiye North, 3.II.1981. D. Fürth. Coll. Israel Ecological Survey, 1♂, 1♀.

This species was described (ANGUS 1985a) from three specimens taken in the mountains of the Georgian SSR. These are the only known specimens, apart from the material listed here.

Subgenus **Helophorus** s. str.

There is no comprehensive revision of the Palaearctic species of this subgenus, though all the species listed below have been discussed, and their aedeagophores figured, in various papers dealing with parts of the subgenus. References are given under each species.

H. nanus Sturm (ANGUS 1971c)

TURKEY. Abant Gölü, 20.V.1987, Jäch (V.). Yüksekova, 3.VI.1987, Jäch (V.). Gümüşhane. Between Erzincan and Kelkit, 2100 m altitude, 4.VI.1986, Besuchet-Löbl-Burckhardt, 1♂, 1♀ (G.).

This is one of the most widely distributed of all the Palaearctic *Helophorus*, occurring from western Ireland all the way east to Vladivostok. It is a northern species, though not on the tundra, and is widespread in Central Europe. I know of no specimens from the Mediterranean, but ZAITZEV (1946) recorded it from the Georgian SSR. I have seen this material, in Zaitzev's collection in Leningrad.

H. frater d'Orchymont (ANGUS 1970b)

TURKEY. Between Van and Baskale, 1600 m, Guzeldere P., 5.VI.1987, Jäch, 16 specimens, including 8♂♂ (V.).

IRAN. E Azerbaijan. Neur Lake, 35 air km ESE of Ardibil, 9.V.1975, R. McCullers, 1♀.

This is a very distinctive species, 3.2-4.5 mm long, with dark brown elytra, a blackish highly arched pronotum which is almost entirely without granules, dull yellowish legs and palpi, and a distinctive aedeagophore (ANGUS 1970*b*, plate 2, Fig. 3). *H. frater* was originally described from northern (Himalayan) India, and, as *H. hingstoni* d'Orch., from southern Tibet. The Zoological Institute, Leningrad, has material from north east Tibet (region of the upper Hwang Ho), and from the Altai region of south-central Siberia (Chuyskaya Steppe (Altai) and the Tuva ASSR (NE of the Altai)). Its occurrence in Iran and Turkey is therefore a matter of some surprise. I had originally omitted the Iranian record from this paper, as it seemed possible that a new species might be involved. However, the Turkish material leaves no doubt of its identity.

H. illustris Sharp (ANGUS 1971*c*)

TURKEY. Not present among the Geneva material, but the following records may be noted: Izmir district (d'Orchymont, 1932) — a long series in d'Orchymont's collection. Mersin, near Erdemli, 1.IX.1981, M. Jäch. (In coll. F. Hebauer, Deggendorf).

D'Orchymont referred to this species as *H. elongatus* Motschulsky, but ANGUS (1970*b*) showed that this is a misidentification, and further pointed out that *H. elongatus* Motschulsky is a junior homonym of *Elophorus elongatus* F. (*Hydrochus elongatus* Schaller), and proposed the name *motschulskyi* for Motschulsky's species. This name must now be abandoned, as study of the relevant type specimen shows that the correct name for *Helophorus elongatus* Motsch, 1860 (nec. F., 1792) is *H. similis* Kuwert, 1887.

H. illustris is a Mediterranean species, distributed from southern France in the west to western Anatolia, the lower Dnepr (coll. A. G. Shatrovsky (Leningrad)) and northern Israel (one specimen, Tel Aviv University coll.) in the east. I have not seen any material from either Spain or North Africa.

H. dorsalis Marsham (ANGUS 1971*c*)

TURKEY. Istanbul, Kilyos, 8.VII.1969, Besuchet, 1♂ (G.).

A rather small specimen with mottled elytra but without the distinct pale subapical and subhumeral spots which are often very clear in this species. The pronotum is also more granulate than usual. Identification is confirmed by the aedeagophore and the elytral flanks, which are broadly visible from below.

H. dorsalis is typical of the deciduous woodland zone of Europe. I know of no Mediterranean records, and the only Russian specimens I have seen are from Kamenets Podolsky in the Ukraine and from near Krasnodar, north of the western end of the Caucasus.

H. kirgicus Knisch (ANGUS 1970*b*)

IRAN. W. Azerbaijan: Sufian, 30 km W of Tabriz, 38°17'N, 45°59'E, 20-21.VI.1970, ♂♂, ♀♀ (P.). E Azerbaijan: 78 km N of Khalkhal (Hero-abad), 23.VI.1975, R. McCullers, 1♀.

This species was described from Uralsk, and is characteristic of the steppe region of West Siberia and northern Kazakhstan. It is very unusual in having only two larval instars (morphologically equivalent to instars 1 and 3 of normal species), a fact discovered in the

course of rearing experiments done at Karasuk (W Siberia) in 1982. This appears to be an adaptation to a short period when water is available in the Spring, and is also shown by *H. pallidipennis* Muls & Wach (q. v.).

H. lapponicus Thomson (ANGUS 1969, 1986)

TURKEY. Not present among the Geneva material, but occurring in the Kars region: Ardahan, Merdenek, Sarikamys, coll. Zaitzev, Leningrad (type material of *H. satunini* Zaitzev (ANGUS 1986)).

IRAN. E Azerbaijan: 78 km N of Khalkhal (Hero-abad), 23.VI.1975, R. McCullers, 3♂♂, 3♀♀.

This is a northern species, with a distribution extending from northern Scandinavia east to the Magadan Oblast of eastern Siberia. It has a number of isolated southern populations, relicts of the Last Glaciation. These occur in Spain, E Anatolia and Russian Transcaucasia, N Iran, and Lake Legmia in Lebanon (Angus, 1986).

H. limbatus Motschulsky (ANGUS 1986)

IRAN. Fars: loc. 220. S Iran, Korsiash, 28°46'N, 54°2'E, 29-30.V.1973. In a slightly saline brook with clayey banks, 5♂♂, 6♀♀ (P.). Fars. Loc. 250. S Iran, Naqsh-e-Rostam, 30°02'N, 52°53'E, 20-21.VI.1973. At light, 5♂♂ (P.).

ANGUS (1970*b*) mistakenly synonymised *H. limbatus* with *H. lapponicus*, but corrected this in 1986. *H. limbatus* was described from Dauria (Transbaikalia), and occurs in Mongolia (all the Mongolian *H. lapponicus* records given by Angus (1970*b*) refer to *H. limbatus*), the Altai district (coll. Zoological Institute, Leningrad) and west to Karkaralinsk in northern Kazakhstan (ANGUS 1986). The Iranian records thus represent a striking extension to its known range.

Separation of *H. limbatus* and *H. lapponicus* can be difficult, especially as the aedeagophores of the two species are very similar. The Iranian *H. limbatus* have their elytral apices more tapered and more deflexed than *H. lapponicus* (especially the Iranian *lapponicus*), and show the extensive mottling of the elytra figured in ANGUS (1986), although rather faintly. This mottling is absent in the Iranian *lapponicus*.

H. minutus F. (ANGUS 1969, 1986)

TURKEY. Istanbul. Altinşehir, 28.VII.1969, Besuchet, 3♀♀ (G.). Halkali near Istanbul, 3.VIII.1969, Besuchet, 2♀♀ (G.).

None of the specimens shows the broader pronotum and more robust appearance normally associated with *H. paraminutus* Angus, so the identification is probably correct. *H. minutus* is widespread in Europe, and extends as far east as Perm in the USSR. It is apparently widespread in the Mediterranean region, but in the extreme south of Spain there is an as yet undescribed species, morphologically virtually identical with *H. minutus*, but with different chromosomes, and which produces abortive embryos or larvae which die before pupation, when crossed with *H. minutus*. This casts doubt on records of *H. minutus* from the extreme south of Spain and from North Africa.

In inland regions of Transcaucasia *H. minutus* is replaced by *H. hilaris* Sharp, but it occurs near Batumi on the Black Sea coast.

H. paraminutus Angus (ANGUS 1986)

TURKEY. Prov. Antalya, Side. 30.V-3.VI.1984. At light. K. & S. Wellschmied leg. 1♂, in coll. F. Hebauer, Degendorf.

Identified as *H. paraminutus* by the robust aedeagophore. The maxillary palpi are more elongate than in any of the *H. minutus* listed above.

H. hilaris Sharp (ANGUS 1986)

TURKEY. Central Anatolia, Bünyan, 38°51'N, 35°52'E, 15.VI.1970 (P.). Karacadağ near Diyarbakir, 28.V.1987, Jäch (V.). E of Diyarbakir, 29.V.1987, Jäch (V.). Bismil E of Diyarbakir, 29.V.1987, Jäch (V.). S of Silvan, 29.V.1987, Jäch (V.). Silvan, 100 km E of Diyarbakir, 29.V.1987, Jäch (V.). Mardin Mts, 30.V.1987, Jäch (V.). Mountains E of Cizre (Mardin), 10.V.1966 (V.). W of Cizre, 30.V.1987, Jäch (V.). Cizre, at light, 30.V.1987, Jäch (V.). SE Turkey, 5 km W of Şirnak, 31.V.1987, Jäch (V.). Small stream 25 km W of Şemdinli, 3.VI.1987, Jäch (V.). Lake Van, east bank, 7.VI.1987, Jäch (V.). Mutki, W of Tatvan, 8.VI.1987, Jäch (V.). 60 km SE of Tatvan, 8.VI.1987, Jäch (V.). Hizan, S of Lake Van, 8.VI.1987, Jäch (V.). Between Muş and Bingöl, 11.VI.1987, Jäch (V.). SE Anatolia, 30 km N of Baskale, 2600 m altitude, 38°02'N, 44°00'E, 20.VIII.1970 (P.). Between Van and Baskale, 2600 m, Güzeldere P., 5.VI.1987, Jäch (V.). Yüksekova, 3.VI.1987, Jäch (V.). S of Yüksekova, 4.VI.1987, Jäch (V.).

IRAN. W. Azerbaijan: N of Saghez, 36°23'N, 46°12'E, 18.IX.1973, Senglet (G.). Mahabad, 36°47'N, 45°45'E, 24.IV.1975, Senglet (G.). 15 km NW of Maku on the Pan-Asian road, 20.IX.1975, R. McCullers.

E Azerbaijan: Neur Lake, 35 air km ESE of Ardibil, 24.IX.1975, R. McCullers. 78 km N of Khalkhal (Hero-abad), 23.VI.1975, R. McCullers. 58 km NW of Ardibil on the Meshkinshah road, 25.VI.1975, R. McCullers. 20 km SE of Marand, 5-6.VII.1973 (P.). Guilan: Nav's valley, 1800 m altitude, 2.VIII.1973, S Vit. (G.). Zendjan, 36°43'N, 48°21'E, 15.IX.1973, Senglet (G.). Kordestan: Sheikh Ata, 35°20'N, 46°28'E, 16.IX.1975, Senglet (G.). Hoseynabad, 35°33'N, 47°08'E, 17.IX.1975, Senglet (G.). Marivan, 35°30'N, 46°09'E, 15.IX.1975, Senglet (G.). 41 km SW of Bijar, 18.VII.1975, R. McCullers. Tehran: Firuzkuh, 35°45'N, 52°46'E, 23.VII.1973, Senglet (G.). Kermanshah: Mahi Dasht, 34°14'N, 46°42'E, 4.VIII.1975, Senglet (G.). Lorestan: between Malavi and Shahabad, 1400 m altitude, 33°35'N, 47°14'E, 25.VI.1974, Senglet (G.). Ilam: Tchaharmelleh, 35°57'N, 46°17'E, 28.VI.1974, Senglet (G.). Kohkiluyeh: Charam, 30°35'N, 50°44'E, 23.V.1974, Senglet (G.). Esfahan: Nowghan, 33°14'N, 49°59'E, 7.VIII.1973, Senglet (G.). Fars: Izad Khast, 31°31'N, 52°09'E, 16.VIII.1973, Senglet (G.). Arjan, Into, Res, 60 km W of Shiraz, 20.II.1975, R. McCullers. loc. 220, Korshiah, 28°46'N, 54°25'E, 29-30.V.1973 (P.).

In addition to the localities listed above, *H. hilaris* is common in inland localities in the Transcaucasian republics of the USSR, and also occurs in Lebanon.

H. mervensis Semenov (ANGUS 1986)

IRAN. W Azerbaijan: 19 km ESE of Miandoab on the Shahindozh road, 1.VII.1975, R. McCullers. 33 km SE of Maku on the Pan-Asian road, 20.IV.1975, R. McCullers. Ilam: Sarab Eyvan, 33°45'N, 46°22'E, 26.VI.1974, Senglet (G.). Khusestan: 90 km N of Ahwas on the Andemeshk road, 18.II.1975, R. McCullers. (A long series). Kerman: loc. 186, Deh Bakri, 29°03'N, 57°56'E, Kuh-e-Jebah Bareg, 1700-1750 m altitude, 30.IV-4.V.1973 (P.). Baluchistan: Ghasemabad, 27°10'N, 60°20'E. In the river Bampur, 11-12.IV.1973 (P.).

AFGHANISTAN. E of Kandahar, 31°37'N, 65°53'E, 1.VIII.1975, Senglet (G.).

H. mervensis is widely distributed over the dry steppe and demi desert regions of the Palaearctic, from Armenia and the Hejaz and Yemen in the west, eastwards over Iran and the Middle Asian republics of the USSR to Afghanistan and Kashmir. *H. aethiopicus* Regimbart, from Ethiopia, appears closely related to it, but this requires further investigation.

H. griseus Herbst (ANGUS 1969)

TURKEY. Edirne, 8-12.VI.1947 (P.). Istanbul. Forest of Belgrade, 10.VI.1969, Besuchet (G.). Istanbul. Altınşehir, 28.VII.1969, Besuchet (G.). Bursa S of Bursa, 23.VII.1969, Besuchet (G.). NW Anatolia. Bolu dag Gerece, 1200 m altitude, 40°48'N, 32°12'E, 14.IV.1970 (P.). Kayseri, between Pazarören and Bünyan, 1400 m altitude, 5.V.1978, Besuchet-Löbl (G.). Gümüşhane, between Erzincan and Kelkit, 2100 m altitude, 4.VI.1986, Besuchet-Löbl-Burckhardt, 2 very dark ♂♂ (G.).

H. griseus is widely distributed in Europe, from England, France and central Spain in the west, eastwards through southern Scandinavia, Central Europe and Yugoslavia, and in Russian north to Leningrad and south to the Crimea. The collections of the Zoological Institute, Leningrad, contain 1 ♀ from Echmiadzin, Armenia.

H. longitarsis Wollaston (ANGUS 1969)

TURKEY. Burdur, 21 km SE of Burdur, 1200 m altitude, 5.V.1975, Besuchet-Löbl (G.). Mogan golu, Anatolia, 5.VII.1947, Prague.

H. longitarsis is widespread in southern and central Europe, and also occurs in North Africa and Israel. In the USSR it occurs in the Crimea, N Ossetia on the northern side of the Caucasus and eastwards to Karaganda (Kazakhstan) and Karasuk in south west Siberia.

H. kerimi Ganglbauer (ANGUS 1971c)

IRAN. W Azerbaijan: 50 km SE of Arab Dize on the Qareh-Ziaeh Din road, 30.VI.1975, R. McCullers, 50 km NW of Maku on the Pan-Asian road, 20.IX.1975, R. McCullers. E Azerbaijan: 23 km SE of Jolfa, 18.IX.1975, R. McCullers. Khorasan: Emamgholi, 37°26'N, 58°30'E, 15.VII.1974, Senglet (G.). Shandiz valley, 36°22'N, 59°15'E, 25.VII.1974, Senglet (G.). 36 km S of Bidokht on the Birjand road, 8.VI.1975, R. McCullers. 23 km N of Soltanabad on the Pan-Asian road, 10.VI.1975, R. McCullers. 34 km N of Qaen, 8.VI.1975, R. McCullers. 50 km S of Shahabad on the Birjand road, 6.VI.1975, R. McCullers. 29 km N of the Gold Mosque in Mashad, 1.VI.1975, R. McCullers. Hesar, 50 km ESE of Nishapur, 36°02'N, 59°20'E, 12-13.VI.1977 (P.). 36 km N of Gonabad, 34°40'N, 58°57'E, 7-8.VI.1977 (P.).

H. kerimi is distributed from the eastern part of *Transcaucasia* (Azerbaijan) over Iran and Soviet Central Asia (Golodnaya Steppe) to Mongolia.

H. pallidipennis Mulsant & Wachanru

reitteri Kuwert.

vinctus Sharp **Syn. n.**

var. *kervillei* d'Orchymont.

TURKEY. SE Turkey, 5 km W of Sirnak, 31.V.1987, Jäch (V.). Karaçadag near Diyarbakir, 28.V.1987, Jäch (V.). S Anatolia, Karaman, Mulsant & Wachanru (type locality). Besica Bay, 39°48'N, 26°12'E, slightly south of the W end of the Dardanelles, opposite the island of Bozca Ada (type locality of *H. vinctus* Sharp). Ankara region, IV.1925. Gadeau de Kerville. In the d'Orchymont collection Brussels (type locality of var. *kervillei* d'Orch.).

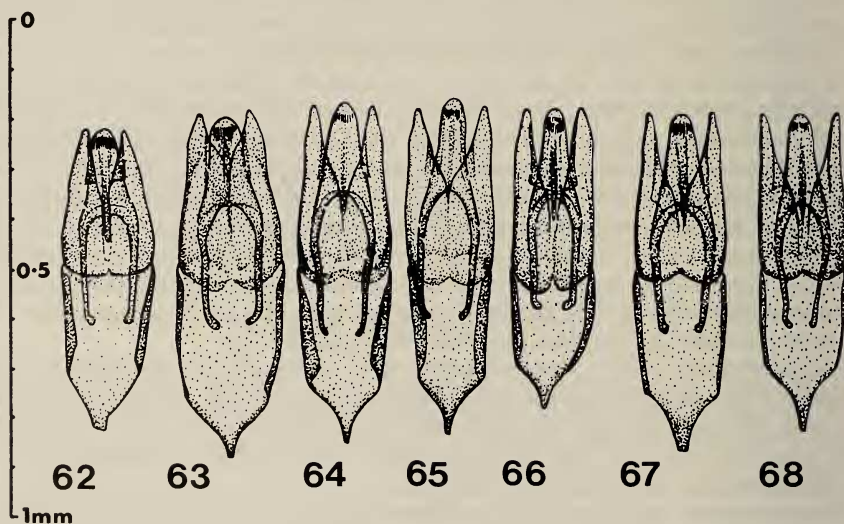
H. pallidipennis is a species about which there has been some confusion. Mulsant's material was destroyed during the last war (ANGUS 1971b, p. 131), and there is now no known type material. It is, however, possible that unlabelled specimens from the same series — or from the same collection — may exist among Rey's material. I misinterpreted the type locality "Carmanie" as Kerman, in southern Iran (ANGUS 1969, p. 20), and hence looked (in vain) for Iranian material in Rey's collection when I visited Lyon in 1968. It is worth noting that *H. acutipalpus* Mulsant and Wachanru (*H. micans* Fald.) was also described from "Carmanie", and that Rey's collection contains *H. micans* labelled "Tarsous, Wachanru" — very probably from the same series as the types (ANGUS 1984). In view of this I do not think it appropriate to designate a neotype for *H. pallidipennis*.

Mulsant and Wachanru describe *H. pallidipennis* as 4.5 mm long, with the head and pronotum coppery or coppery yellow, and the elytra yellow or yellowish brown, without intercalary striae. The head is described as finely granulate, and the pronotal intervals punctate, this punctuation being fine on the internal and middle intervals, somewhat stronger on the externals. The internal intervals are described as having greenish reflections, the others more coppery. The pronotum is said to be feebly narrowed (posteriorly) and the sides almost straight. I know of only two Anatolian *Helophorus* species to which this description might apply — *H. pallidipennis* as here interpreted, and *H. longitarsis* Woll. *H. longitarsis* is unlikely to be the species involved as it is smaller than is indicated in the description — the largest specimens I have seen (from Odessa) reaching only 4.0 mm in length, and most material is less than 3.7 mm. Further, *H. longitarsis* normally has the head punctate, like the pronotum, not granulate. *H. pallidipennis*, on the other hand, may be up to 4.9 mm in length, and the sculpture of the head and pronotum is more variable. However, it may have the head granulate while the pronotal intervals are only punctate. The pronotal shape may be as indicated in the description, though the pronotal sides are often more rounded, and the pronotum more narrowed basally.

Two other species, which, while not known from central southern Anatolia, occur in the Russian Transcaucasus, may also be excluded on pronotal shape. These are *H. kerimi* Gangl. and *H. angustatus* Motsch. Both have the pronotum more strongly narrowed basally, and the sides are not almost straight. Thus the present interpretation of *H. pallidipennis* is almost certainly correct.

The species may be characterised as follows: length 2.8-4.9 mm (♂♂ to 3.8 mm). Head and pronotum yellow, brassy bronze or greenish bronze, sometimes quite darkly so, but the marginal grooves and anterior margin of the pronotum always pale, yellowish. Antennae 8-segmented, with only two segments between the pedicel and the cupule. Head with stem of Y-groove expanded anteriorly, often rather wide. Pronotum weakly arched, the grooves rather wide and shallow, the marginal groove often noticeably wide. Pronotum slightly or quite strongly contracted basally, the sides either fairly straight or quite strongly curved. Sculpture of pronotal intervals varying from granulate to punctate, strongest laterally. The mid groove of the pronotum may have a hint of a median raised line, as mentioned by Mulsant and Wachanru, but this is not usual. Elytra elongate, moderately to rather finely striate, the interstices flat to weakly convex, often a little more convex apically. Flanks visible from below, outside the elytral epipleurs (ANGUS 1969, Figs 2 & 3), wide or narrow. Elytra yellow, with or without dark marks, to dark pitchy

greenish. Legs elongate, yellow. Aedeagophore (figs 62-68) with the struts longer than the tube, but with the relative lengths of the parameres and basal piece variable, and the parameres varying from slender, attenuate (Fig. 66) to much more robust (Figs 62, 63). This aedeagal variation is unusual within single species of *Helophorus*, and requires careful consideration of the possibility that more than one species is involved. The aedeagophores with relatively long slender parameres are characteristic of smaller specimens ($\sigma\sigma$ 2.8-3.2 mm, $\text{♀}\text{♀}$ to 4.2 mm), and include var. *kervillei* (Fig. 66). This is the only form I have seen from Corfu, and I have also seen it from Israel (coll. M. Jäch, Vienna). The more robust form of aedeagophore is characteristic of larger specimens ($\sigma\sigma$ 3.4-3.8 mm, $\text{♀}\text{♀}$ to 4.9 mm), and I have seen it from Greece (Parnassos), Crete, Anatolia (Besika Bay and Ankara) and Israel (coll. M. Jäch (Vienna) and Israel Ecological Survey (Jerusalem)). Israeli specimens (Figs 67, 68) have the parameres sharply pointed, slender apically. The aedeagophore shown in Fig. 68 is from a specimen 3.0 mm long, that shown in Fig. 67 from one 3.5 mm long. Taken as a whole, Figs 62-68 suggest that the relative lengths of the parameres and basal piece intergrade between the two extremes, as does the robustness or slenderness of the parameres. The shape of the tube and struts shows hardly any variation. There thus seems no reason to believe that more than one species is involved.



FIGS. 62-68.

H. pallidipennis Muls. & Wach., aedeagophores, traced from photographs. 62, *H. vinctus* Sharp, holotype; 63-66, specimens from near Ankara, leg. Gadeau de Kerville; 66, *H. pallidipennis* var. *kervillei* d'Orch., lectotype; 67, 68, from Israel.

D'ORCHYMONT (1924, 1932) had a confused concept of *H. pallidipennis*. He included both *pallidipennis* as interpreted here (Greek specimens), and the western *H. asturiensis* Kuwert (ANGUS 1986) (Moroccan specimens). *H. asturiensis* differs from *pallidipennis* in having 9-segmented antennae, the elytral flanks not or very narrowly visible from below, and the aedeagophore with the struts much shorter than the tube (ANGUS 1986, Fig. 89).

H. pallidipennis is an exclusively east Mediterranean species, known from Greece and its islands, Anatolia and Israel. KUWERT (1886) included Russia, but there are no specimens in the collections of the Zoological institute, Leningrad.

The synonyms may now be discussed.

H. reitteri Kuwert, 1885. — Kuwert described this species from four specimens from mount Parnassos. His description (1885: 292) was written in ignorance of Mulsant's *H. pallidipennis*. Subsequently (1885: 312) he placed *reitteri* as a variety of *pallidipennis*, differing only in having black marks on the elytra.

Kuwert's collection, in the Museum National d'Histoire naturelle, Paris, has six specimens standing as *H. reitteri*. Five are labelled "Graecia. Parnassos v. Oertzen", one is labelled "Parnass", and one lacks data. None has an individual name label. The Reitter collection, in the Hungarian Natural History Museum, Budapest, has four specimens with the label "Graecia, Parnassos v. Oertzen", and one is labelled "*pallidipennis* Muls. var. *Reitteri* Kuwert" in Kuwert's own handwriting. These specimens have been catalogued by the museum as the types, and this is almost certainly correct. Presumably Kuwert did not label and return the material to Reitter till after he had placed *reitteri* as a variety of *pallidipennis*.

All four specimens are ♀♀. Their lengths range from 4.2-4.9 mm. All are *H. pallidipennis*. I here designate the largest specimen, which bears Kuwert's label, lectotype. It is in the best condition, and has 8-segmented antennae. The other specimens are paralectotypes.

At least five of the Paris specimens are from the same series, and there is a further specimen with the same data in d'Orchymont's collection (ex. coll. Knisch). It is ♂, and the aedeagophore is of the robust pattern shown in Figs 62, 63.

H. vinctus Sharp. — The holotype of *H. vinctus* is described by Angus (1969), where a photograph of the aedeagophore is given. A drawing from this photograph is shown in Fig. 62. *H. vinctus* is identified as *H. pallidipennis* by the aedeagophore (the robust form), the 8-segmented antennae, and the absence of any feature disagreeing with *H. pallidipennis*.

H. pallidipennis var *kervillei* d'Orchymont. This form is discussed, and a lectotype designated, by ANGUS (1969), where a photograph of the aedeagophore is given. A drawing from this photograph is shown in Fig. 66. As mentioned above, var. *kervillei* represents those specimens of *pallidipennis* whose aedeagophores have the longest, most slender parameres, and the shortest basal pieces. D'Orchymont mentioned that var. *kervillei* intergraded with normal *pallidipennis* in details of its pronotal sculpture and colour, and Figs 63-66 show that there is a matching intergradation of aedeagal form. It seems that var. *kervillei* should retain its varietal status, but that the aedeagal distinction is probably more important than the details of pronotal colour and sculpture.

H. angustatus Motschulsky (ANGUS 1969, 1971c)

IRAN. W Azerbaijan: Sufian, 30 km W of Tabriz, 38°17'N, 45°59'E, 20-21.VI.1970 (P.). Sistan: Kuh-e-Khajeh, 490 m altitude, 30°56'N, 61°15'E, 3-5.VI.1977 (P.). Khusestan: Siahmakan Elil, about 70 km N of Bander Genavel, 30°04'N, 50°11'E, 17-18.IV.1977 (P.). 5 km W of Siahmakan Elil on the road from Omidiyeh to Bander Genavel, 30°04'N, 50°16'E. In a slightly saline stream, 18.IV.1977 (P.). Fars: Baghak, 15 km W of Ahran, 28°52'N, 51°10'E. Saltlands on the edge of fields and grove of date palms. At light, 19-20.IV.1977 (P.). Jashak, 60 km SE

of Kormuj, 28°11'N, 51°42'E. Gypsum hills with water pools, 20-21.IV.1977 (P.). 25 km SE of Taheri, 27°34'N, 52°33'E, 22-24.IV.1977 (P.). Konarda, 36 km E of Gav Bandi. At light, 32-24.IV.1977 (P.).

H. angustatus was described from Egypt and it also occurs in Soviet Armenia and Middle Asia. It appears characteristic of semidesert regions.

H. discrepans Rey (ANGUS 1969)

TURKEY. NW Anatolia, Gerede, Bolu daglari, 1200 m altitude, 14.VI.1970 (P.). Çamildere, Isik dag. Anatolia, 23.VI.1947 (P.). Ercivas, 3200 m altitude, Anatolia, 23.VII.1947 (P.). SE Anatolia, 20 km NE of Yüksekova, 2100 m altitude, 20.VIII.1970 (P.). S of Yüksekova, 4.VI.1987, Jäch, 1♂ (V.). SE Anatolia, 30 km N of Baskale, 2600 m, 21.VIII.1970 (P.). Artvin. Pass between Savçat and Ardahan, 2650 m altitude, 12.VI.1986, Besuchet-Löbl-Burckhardt (G.).

IRAN. Guilan: Djirandeh road, 1000 m altitude, 36°49'N, 44°00'E, 9.VIII.1974, A. Senglet, 1♂, 4 unsexed (G.). Mazanderan: Behshahr, 36°43'N, 53°34'E, 25.VII.1970, 18 specimens (P.). Tehran: Central Elburz, Kandeivan pass, 3000 m altitude, 36°07'N, 51°19'E, 11.VIII.1970, 1 specimen (P.). Bakhtiyari: Kuhrang, 2700 m altitude, 32°29'N, 50°04'E, 9.VIII.1973, Senglet, 1♀ (G.). Fars: Eastern Zagros, 29 km E of Yasuj, 10 km NW of Karum, 2300 m altitude, 30°41'N, 51°43'E, 16-17.VII.1973, 2♂♂ (P.).

H. discrepans is widely distributed in Europe, occurring in upland areas from northern Spain, eastwards over Central Europe to the Balkans, Anatolia and Transcaucasia, and occurring on low ground near Leningrad and east at least to Yaroslavl. It also occurs in the Atlas Mountains of Morocco (ANGUS 1987), and occurred in Britain during the thermal maximum of the last glaciation, about 43,000 years ago (fossil material, including aedeagophores) from Tattershall, Lincolnshire.

The Iranian records are an addition to its known distribution and represent the south eastern limit of its range.

H. obscurus Mulsant (ANGUS 1971*b*)

TURKEY. Kirklareli. Between Yeniçeköy and Demirköy, 31.VII.1969, Besuchet (G.). 11 km SE of Demirköy, 31.VII.1969, Besuchet (G.). Istanbul. Forest of Belgrade, 10.VII.1969, Besuchet (G.). Kilyos, 8.VII.1969, Besuchet (G.). Altınşehir, 28.VII.1969, Besuchet (G.). 80 km W of Istanbul, 15.V.1987, Jäch (V.). Ömerli E of Istanbul, 18.V.1987, Jäch (V.). Between Sile and Agva, 19.V.1987, Jäch (V.). Bursa. Uludag, 1900 m altitude, 22.VII.1969, Besuchet, 1♂ (G.). Bolu. Ömerler near Bolu, 800 m altitude, 21.V.1970, Besuchet, 1♀ (G.). Sinop. S of Bektras, 23 km N of Boyabat, 1100 m altitude, 20.V.1976, Besuchet-Löbl, 1♀ (G.).

H. obscurus is widely distributed in Europe, north to Britain and southern Sweden, and throughout the European Mediterranean region, except Spain, where it is confined to the north coast and Cantabria. All the Russian material I have seen is southern, from the Crimea, Krasnodar district, and Transcaucasia, where it is widespread. This species is characteristic of neutral or alkaline waters.

H. flavipes F. (ANGUS 1971*b*)

TURKEY. Gümüşhane. Between Erzincan and Kelkit, 2100 m altitude, 4.VI.1986, Besuchet-Löbl-Burckhardt, 1♀ (G.). Kars, 13.V.1916, Behning, 1♂, 1♀. Among the paralectotypes of *H. satunini* Zaitzev (= *lapponicus* Thomson) in the Zoological Institute, Leningrad.

H. flavipes is an acid water species, widespread in Europe, and occurring much further north than *H. obscurus*. In the South I have seen it from northern and central Spain and the Balkans (not Greece). All the Russian material I have seen is northern, and it is apparently absent from Transcaucasia. The eastern Anatolian records thus appear rather isolated.

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